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NAVAL POSTGRADUATE SCHOOL
Monterey, California

THESIS

AN ORGANIZATIONAL ANALYSIS
OF WEAPON SYSTEMS MANAGEMENT
WITHIN THE NAVAL AIR SYSTEMS COMMAND

by

William Clark Davis

September 1977

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The result of the evaluation indicates that while there are good features to the Weapon Systems Management process, there are many areas needing improvement that reduce overall effectiveness.

The study also provides a comprehensive source for understanding the overall Weapon Systems Management organization within the Naval Air Systems Command.

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AN ORGANIZATIONAL ANALYSIS OF WEAPON SYSTEMS MANAGEMENT WITHIN THE NAVAL AIR SYSTEMS COMMAND

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The primary objective of this study was to provide a basis for improving the effectiveness of Weapon Systems Management within the Naval Air Systems Command.

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I. INTRODUCTION

A. STATEMENT OF PROBLEM

The organizational structure of the Naval Air Systems Command has been undergoing some gradual but rather significant changes. Continuous efforts have been made to make it more efficient by reorganizing and consolidating various functions. There has also been a trend to decentralize as evidenced by the translation of management responsibilities on a number of weapon systems from the Naval Air Systems Command Headquarters in Washington, D.C. to selected Field Activities.

One major change that previously took place in early 1973 was the establishment of the NAVAIRSYSCOM Model Management Program in which overall management responsibilities on certain out-of-production aircraft were reassigned to selected Naval Air Rework Facilities. The program has since been extended to include additional weapon systems assigned to different types of Field Activities.

There are current attempts to improve logistics management on out-of-production weapon systems assigned to Model Management. This includes the reassignment of Cognizant Field Activity engineering and material management responsibilities to the Model Management office. Also, a proposed Material Management Program is currently being prototyped in the F-4 Model Management office at the Naval Air Rework Facility, North Island, California. The proposed program

will consolidate functional responsibilities currently being performed by the Aviation Supply Office, the Naval Air Systems Command Headquarters, and their representatives in the areas of aircraft and component rework/modification.

Another major change that is currently underway is the establishment of the Naval Aviation Logistics Center, Patuxent River, Maryland on October 1, 1977. This Center will be the new central activity for providing overall logistics support to the Fleet. Former functional logistics support groups located at the Naval Air Systems Command Headquarters and certain Field Activities are currently being relocated to this new Center.

These reassignments of program responsibility are quite often accomplished with the good intentions of reducing the bureaucratic structure at the Headquarters level but with the detrimental effect of not providing the full authority, resources, and support necessary to maintain total program effectiveness. This applies to management of weapon systems remaining at Headquarters as well as those that have been reassigned. It was because of these changes and the apparent lack of understanding by all concerned of the overall Weapon Systems Management organization including those requirements that make it effective that this study was undertaken.

B. OBJECTIVE OF STUDY

The primary objective of this study was to improve the effectiveness of Weapon Systems Management within the Naval Air Systems Command.

Additional objectives in support of the primary objective were:

1. To identify both good features as well as deficiencies in the Weapon Systems Management organization with the intent of influencing corrective action.

2. To clearly define Weapon Systems Management in terms of its basic organizational elements.

3. To provide a source for understanding the Weapon Systems Management organization for both participants and non-participants.

C. OUTLINE OF STUDY

Section I presents a brief introduction by discussing the problem and objectives of the study.

Section II provides overall background for the study by discussing the history of Weapon Systems Management, the different organizational arrangements, basic definitions, life-cycle management concepts, and general systems and organizational diagnosis theory.

Section III describes the procedures used in the collection of data, and in the definition and evaluation of the Weapon Systems Management organization.

Section IV provides a detailed definition of the Weapon Systems Management organization by the application of a Systems Analysis Model.

Section V provides an evaluation of the two distinct Weapon Systems Management organizations, Project Management and Model Management. The evaluation determined the adequacy of Project and Model Management to accomplish their basic operational requirements.

Section VI summarizes the overall study and provides specific conclusions reached as a result of the evaluation.

II. BACKGROUND

A. HISTORY OF WEAPON SYSTEMS MANAGEMENT

Since World War II, there have been significant advancements in technology due primarily to large expenditures for research and development in both the public and private sectors.

The advent of large complex programs have caused the Government and private industry to adapt their organizational structures away from the traditional functional designs. Whenever the task involved coordination of large numbers of agencies and people, the traditional functional approach ceased to be effective. In addition, the conditions of accelerated technology and urgent schedules made it necessary to establish centralized management organizations to provide overall integration of the many diverse functional groups. There have been various terms used to designate these centralized management organizations such as Program Management, Project Management, and Weapon Systems Management. They all, however, have in common the characteristic of centralized integrative management on a system basis [Kast and Rosenzweig, P. 231].

Within the Department of Defense and defense related industries, the term Weapon Systems Management has evolved. The Weapon Systems Management concept emphasizes the timely integration of all aspects of a weapon system including the establishment of operational

requirements through design, development, production, training, operation, and logistics support. The weapon system is a total entity which comprises equipment and facilities in combination to form an instrument of combat [Johnson, Kast, and Rosenzweig, P. 138].

The single central executive designated to manage a major weapon system within the Department of Defense is called a Program or Project Manager.

After World War II, there were evidences of Project Managers on such endeavors as the Manhattan Project, the ballistic missile program, and the Polaris Program. One of the early forerunners of the Project Manager was the "project expeditor" who had no line function responsibility, but informally motivated others in the functional areas. Another forerunner was the "project coordinator" who had more formal responsibility toward coordinating the overall activities in the functional groups toward a specific objective. Although he was free to make decisions within the framework of project objectives, he did not participate in management functions outside of his organization [Cleland, P. 83].

The manager of a weapon system within the Department of Defense today is responsible for actively participating in the basic functions of management - planning, organizing, directing, and controling overall aspects of the project. There are, however, different organizational arrangements which determine his relationships with the other functional groups. The different organizational arrangements are discussed in the following paragraphs.

B. ORGANIZATIONAL ARRANGEMENTS

The traditional way for organizations to define their structure is by charts showing the hierarchy, line-staff relationships, and the different functional divisions. However, the informal structure, which reflects the actual interfunctional relationships and communication channels, is not normally shown. Typical functions with an organization are engineering, manufacturing, marketing, finance, and administration. There are three basic organizational arrangements currently being used today - functional, project, and matrix. [Kline].

1. Functional Organization

Figure 2-1 shows a typical functional organization. The Chief Engineer has line managers as well as staff personnel reporting to him. Each line manager is responsible for managing a particular functional department within the organization. The responsibility for a given project is normally assigned to one of the functional departments until that phase of the project is finished. It will then be transferred to succeeding functional departments until the overall project is completed. Table 2-1 provides a list of advantages and disadvantages of the functional organization. [Kline].

2. Project Organization

The project organization was established to integrate the many diverse functional groups required to support large complex programs where cost and schedule were of critical importance. The project organization is temporary in nature since it is normally

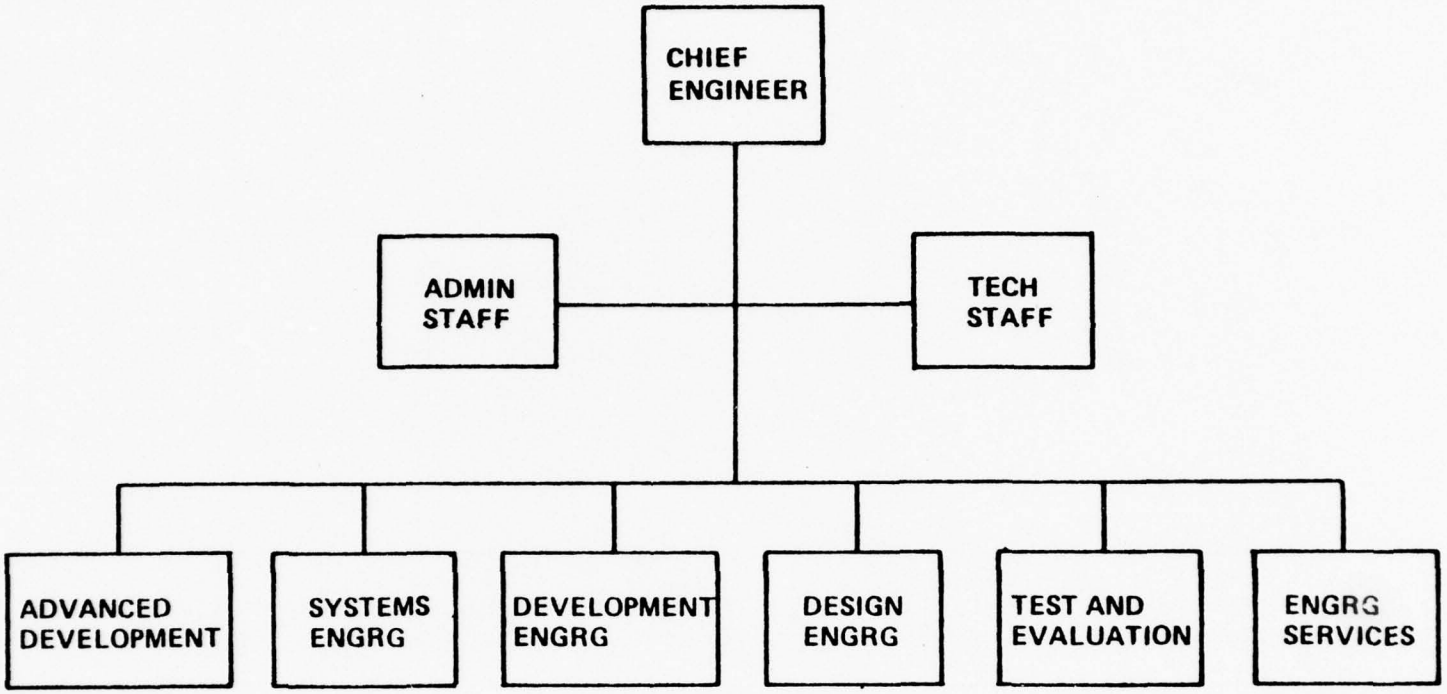
disestablished after the project has been completed.

The pure project organization is a self-contained unit whereby the Project Manager has both administrative and functional control over all personnel assigned to the project. Since project personnel are detached from their functional departments, all matters relating to hiring, firing, performance appraisals, and assignments are the responsibility of the Project Manager.

Figure 2-2 shows a typical project organization in which all aspects of the project such as engineering, manufacturing, quality control, and contract administration are controlled by the Project Manager. In this particular organization, the Project Manager reports directly to the General Manager. There are different variations of the project organization, however. One typical variation, as shown in figure 2-3, is that only technical aspects of the project are controlled by the Project Manager, and he reports directly to the Chief Engineer who is subordinate to the General Manager. Table 2-2 provides a list of advantages and disadvantages of the project organization [Kline].

3. Matrix Organization

Figure 2-4 shows a typical matrix organization. The lines of project authority cut across departmental boundaries to form a grid or matrix type structure. The matrix organization is actually a hybrid form between the functional and project organization. It was designed to incorporate the good features of the functional and project organizations while minimizing their bad features [Kline].



FUNCTIONAL ORGANIZATION

FIGURE 2-1

TABLE 2-1

ADVANTAGES AND DISADVANTAGES OF THE FUNCTIONAL ORGANIZATION

ADVANTAGES

Less total manpower required

Good crossfeed of information among programs

Continuity from program to program

Efficiency and flexibility in the use of manpower

Broader manpower base

Good technical direction

Lines of promotion are clear (technically)

Relative stability and security

Established and consistent procedures

Technical personnel judged for advancement by peers

Good informal organization

High morale

Creative environment for technical advancement

DISADVANTAGES

Discipline (technology) oriented rather than program oriented

Difficulty in selection of project managers

Sometimes "research" rather than application oriented

Too narrow a view of program requirements

May have poor coordination across technical groups

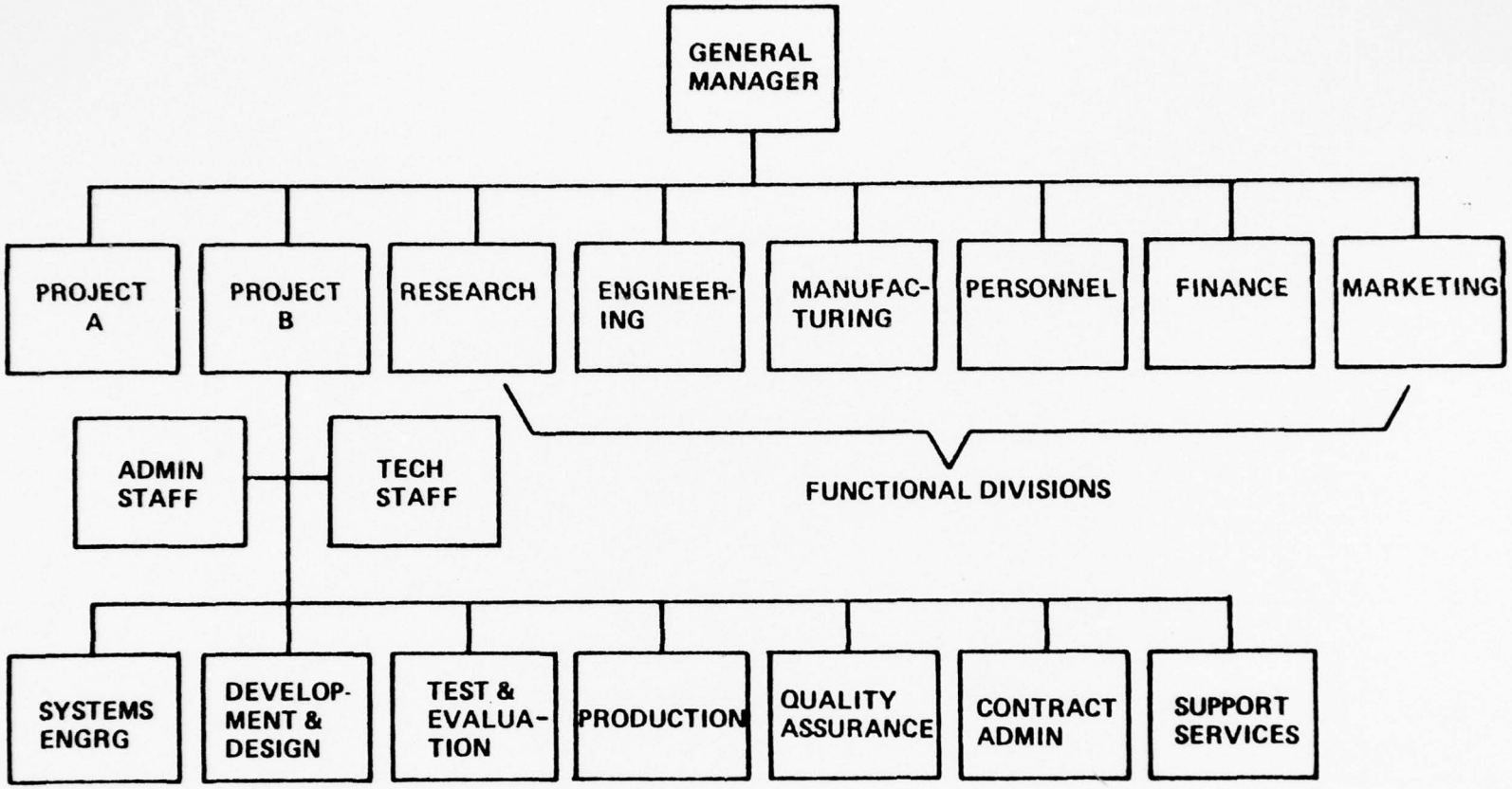
Not all engineers are equally good at management, nor do they necessarily desire to manage

TABLE 2-1
(continued)

Promotion path and rewards sometimes go to project engineer

Interface with customer often poor

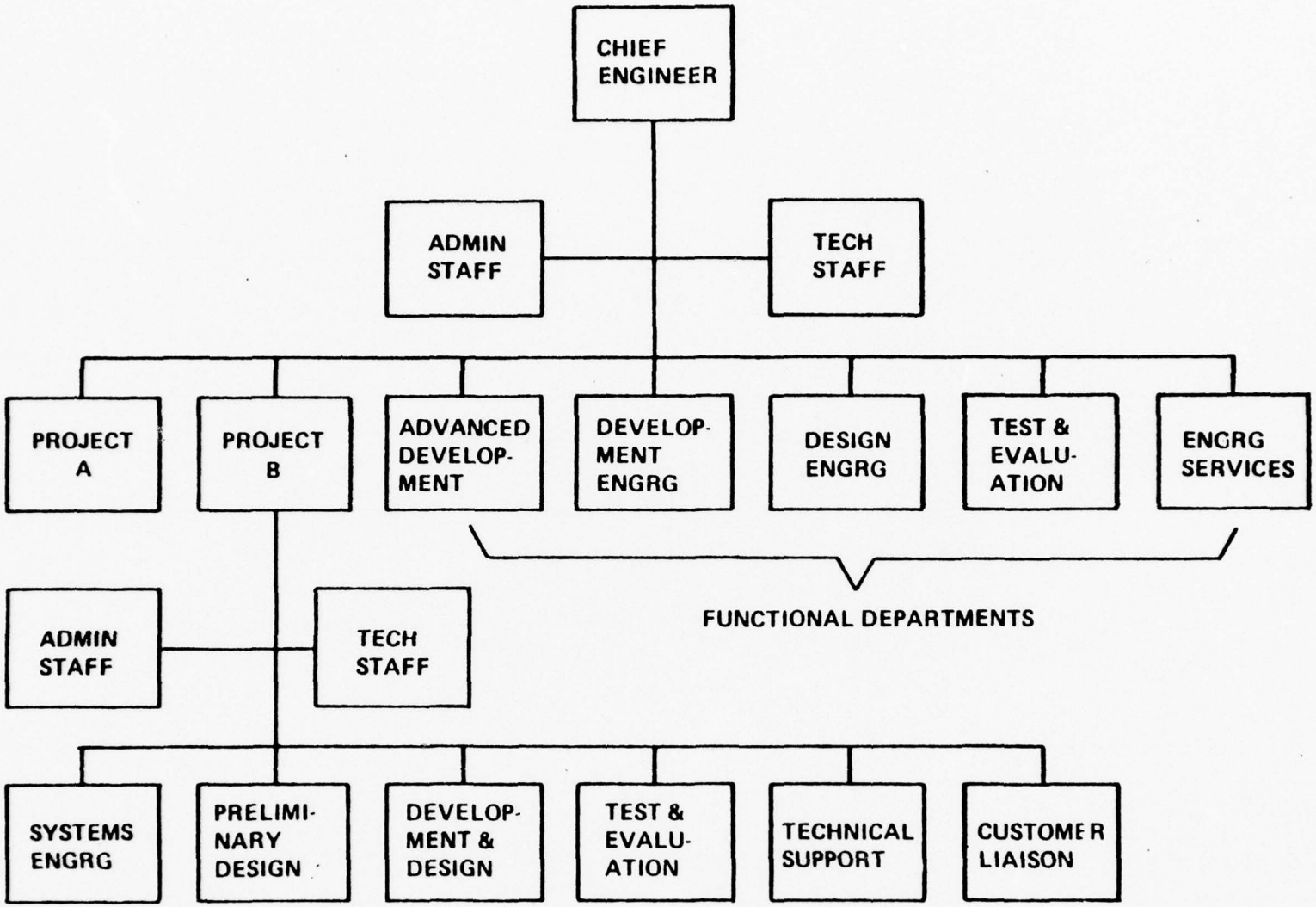
Lack of focus for the program



PROJECT MANAGER WITH COMPLETE PROGRAM CONTROL
(Reports at Same Level as Chief Engineer)

PROJECT ORGANIZATION

FIGURE 2-2



PROJECT MANAGER WITH TECHNICAL CONTROL ONLY
(Reports to Chief Engineer)

PROJECT ORGANIZATION

FIGURE 2-3

TABLE 2-2

ADVANTAGES AND DISADVANTAGES OF THE PROJECT ORGANIZATION

ADVANTAGES

Close coordination contact with customer

Concentrated authority and responsibility

Direct control by Project Manager of all personnel

Project Manager can make authoritative and binding decisions

Task oriented - can act quickly

Good project schedule and cost control

Good program visibility

Sometimes develops Program Managers from functional people

Only one group disturbed when project completed

Accounting is easier

Sometimes best for very large, long duration programs

DISADVANTAGES

Inconsistency in policies, procedures, and operations from project to project.

Depends primarily on leadership ability of Project Manager

Crossfeed of technical information is generally poor

Functional groups in organization tend to neglect the project

Duplication of skills and facilities - higher cost to overall organization

Lower job stability and security for project personnel

Loss of contact by personnel with their technical discipline

TABLE 2-2
(continued)

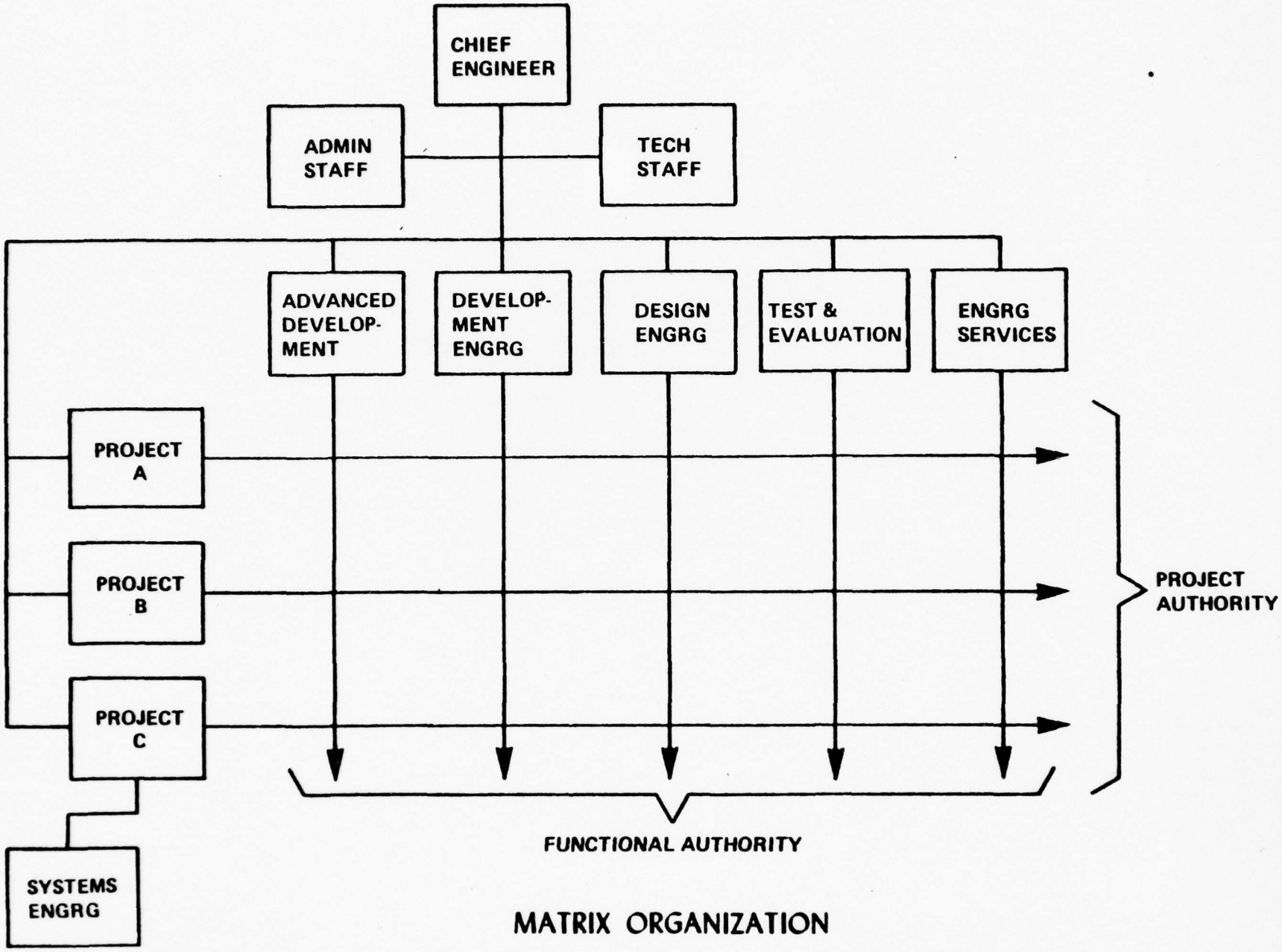
People tend to be graded on cost and schedule performance rather than technical excellence

Technical direction may be weak

Competition for technical talent

Divided loyalty of personnel between project and former functional group

Tendency to retain personnel longer rather than lose them



MATRIX ORGANIZATION

FIGURE 2-4

TABLE 2-3

ADVANTAGES AND DISADVANTAGES OF MATRIX ORGANIZATION

ADVANTAGES

Provides system of checks and balances between program and functional managers

Good horizontal as well as vertical communication

Has many desirable qualities of both functional and project organizations

- Flexible use of manpower
- Stable functional groups
- Technical excellence
- Technical supervision of functional people
- Good cost and schedule control
- Good crossfeed of information
- Close coordination with customer
- Good program visibility

Good interface management - can otpimize technical performance with cost and schedule

Reasonable size work force

Project personnel can concentrate on program task management - technical personnel can concentrate on functional performance

Promotes purposeful conflict

Specialists can be made available from functional group reservoir to solve technical problems in crisis situations

Rotating personnel between projects and functions can develop future managers

Program Manager not burdened with administrative problems of functional personnel

TABLE 2-3
(continued)

DISADVANTAGES

Priorities - competition among projects for technical people

Balance of power between Project and Functional Managers not always clearly defined

Dominant personalities can sometimes prevail

Overlap of authority and responsibility is possible

Technical personnel might try to take advantage of dual reporting role

Divided loyalty of technical personnel

In the matrix organization, technical personnel are functionally assigned to the Project Manager but remain administratively assigned to the functional departments. The Project Manager exercises his authority over functional personnel regarding "what" and "when" project support is provided while the functional department managers determine "how" project support will be given. The Project Manager normally has a small staff that assists in the overall management task and report directly to him on the progress of the project. Table 2-3 provides a list of advantages and disadvantages of the matrix organization [Kline].

C. LIFE-CYCLE MANAGEMENT CONCEPTS

This study has defined Weapon Systems Management in the broad sense to mean the centralized management and integration of all aspects of a weapon system throughout its complete life-cycle. Weapon systems Management within the Navy is designed around a matrix organization as defined in Section II.B.3. During the acquisition of an airborne weapon system, a project office is established, and the manager will usually be a Chief of Naval Material designated Project Manager (PMA) or an Aircraft Project Coordinator (APC) established within the Naval Air Systems Command. After the completion of all production contracts and all major modification programs, the project office is normally disestablished. The Assistant Project Manager for Logistics (APML) assumes lead management responsibility and continues to

support all logistics aspects of the program. The Class Desk engineer maintains lead responsibility for the basic design of the weapon system. At some point in time after the program stabilizes (fewer logistics problems, configuration changes, etc.), the total program responsibility will usually be transferred to a Weapon Systems Manager (WSM) at an appropriate Field Activity under the NAVAIRSYSCOM Model Management program.

When considering the management aspects of a weapon system throughout its complete life-cycle, one way to view the process is by dividing it into three distinct management phases: (1) Pre-Production Phase, (2) Production Phase, and (3) Out-of-Production Phase. Figure 2-5 presents continuums illustrating the degree of program participation by the various managers and the major types of funds utilized during these three phases. These concepts are described in the following paragraphs.

1. Pre-Production Phase

This phase encompasses the total DSARC/NSARC (Defense/Navy Systems Acquisition Review Council) process which includes Milestone 0 (Program Initiation), Milestone I (Demonstration and Validation of Alternatives), Milestone II (Authorization for Full-Scale Engineering Development), Milestone III (Authorization for Full-Scale Production and Deployment). The Pre-Production Phase involves the administration and execution of primarily RDT&E funds over which the PMA/APC exercises full control. The Class Desk (AIR-510) is

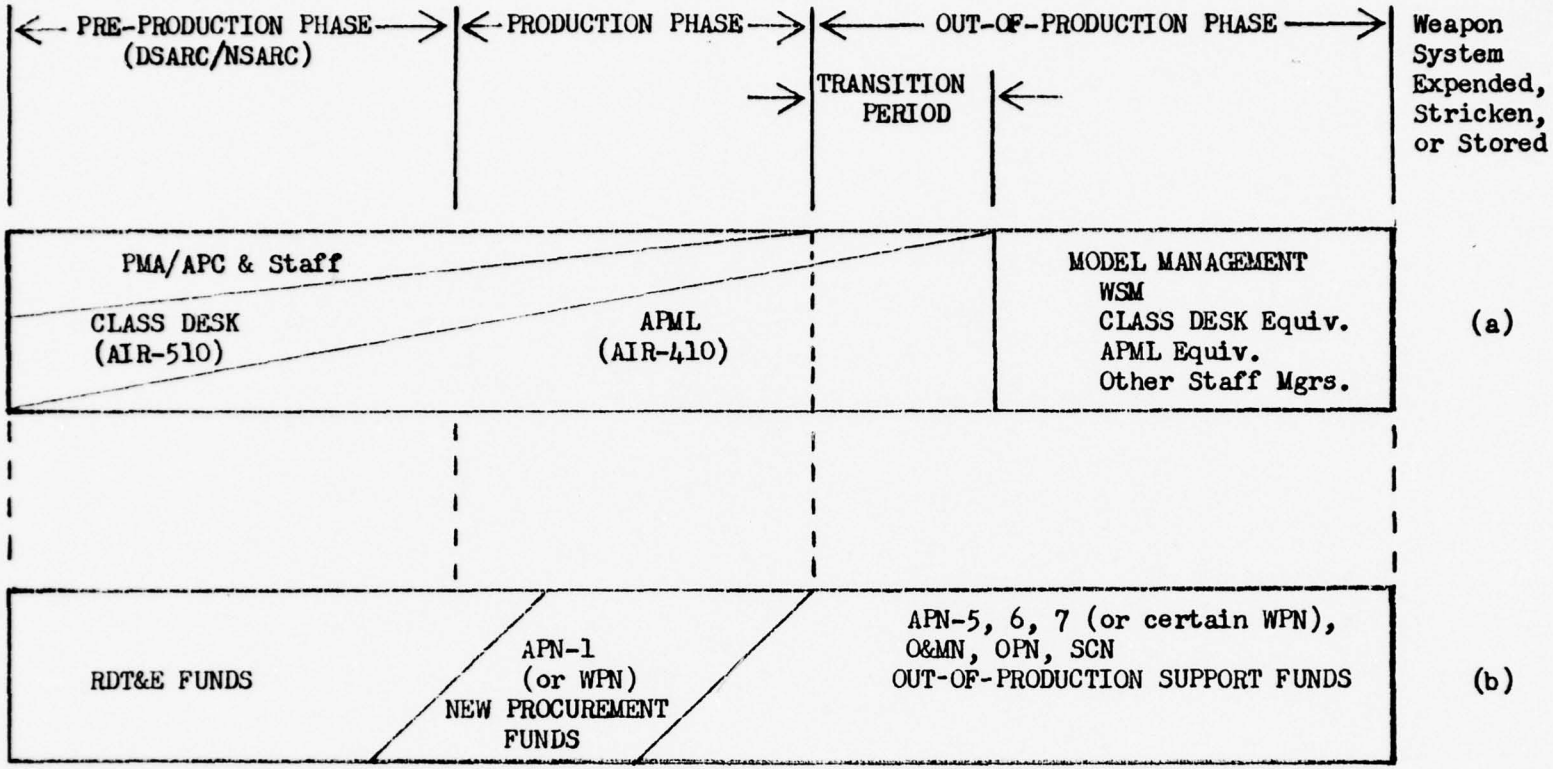


FIGURE 2-5

LIFE-CYCLE MANAGEMENT CONTINUUMS OF A WEAPON SYSTEM

(a) Degree of Program Participation of Various Managers

(b) Major Types of Funds Normally Available to Program

also part of the project team during this phase and assumes the weapon systems acquisition management role which includes lead engineering responsibility for basic systems design. This also includes the management of test and evaluation programs to verify design performance. Another important team member is the APML (AIR-410) who assumes lead responsibility for development of a viable integrated logistics support (ILS) plan.

2. Production Phase

The milestone III decision by the Secretary of Defense is the authorization point for full-scale production. This normally takes place after completion of engineering development, OPEVAL approval of the weapon system for service use, Board of Inspection Survey acceptance, and ASN(I&L) approval and recommendation of the system for production.

Just prior to and during the early part of the Production Phase, the PMA/APC administers and executes his budget using primarily new procurement APN-1 (or WPN) funds. Other types of out-of-production support funds such as APN-5, APN-6, APN-7, (or certain types of WPN funds), OPN, SCN, and O&MN funds must also be budgeted to support the weapon system when it becomes operational in the Fleet. The PMA/APC does not have control over these out-of-production funds, however, he is responsible for ensuring that budgetary inputs are made to the responsible budget administrator for support of his project.

Quite often, during the Production Phase, the weapon system's configuration must be modified to include certain unforeseen improvements. Also, after the initial production contract, there may be follow-on contracts to procure additional weapon systems of the same series or of a later series. As long as the weapon system is still in production, correction of basic design problems can be accomplished using initial production (APN-1 or WPN) funding over which the PMA/APC exercises full control. Non-conformance with approved specifications while the weapon system is still under warranty can often be corrected at no cost to the Government. Retrofit kits to update the systems already operational in the Fleet to the current production configuration must be procured using APN-5 (or certain types of WPN) funds. Aircraft modification APN-5 funds are administered by AIR-1041.

During the Production Phase, the Class Desk (AIR-510) continues his team responsibility for basic design and sponsors changes in the configuration of the system before the Change Control Board. On some projects, a member of the Project Manager's staff sponsors the changes before the Board.

The role of the APML (AIR-410) increases during the Production Phase in preparation for logistics support requirements of the weapon system when it becomes operational in the Fleet.

3. Out-of-Production Phase

The weapon system is considered out-of-production following the completion of the last production unit. It is not unusual, however, for an earlier series to be out-of-production while a later series of the same type and model is still in production (example: A-7C and A-7E). At the termination of the last production contract, the acquisition function of the PMA/APC ceases, and the project office is normally disestablished. An exception to this takes place when there is a major modification program underway. In this situation, the project office will usually remain in operation until completion of the modification program.

During the Out-of-Production Phase, the weapon system management lead is initially assumed by the APML (AIR-410). This is not an abrupt management transition since the APML has previously had an increasing role in planning and managing the integrated logistic support for the systems already operational in the early Production Phase.

Funding support for operational weapon systems in-production and out-of-production normally includes APN-5, APN-6, APN-7, (or certain types of WPN), O&MN, OPN, and SCN funds. In contrast to the project administration of RDT&E and initial procurement (APN-1 or WPN) funds for a particular weapon system, these out-of-production funds are normally managed within NAVAIRSYSCOM by designated budget administrators in the functional areas who have to support all

operational weapon systems. Modifications to out-of-production aircraft weapon systems are funded by the Operational Safety Improvement Program (OSIP). For example, OSIP APN-5 funds are administered by AIR-1041, and rework modification O&MN funds are administered by AIR-4148.

After an initial transition period, and the management of the program becomes more stable (fewer logistics problems, changes, etc.), the total systems management responsibility is usually translated to a Field Activity such as a Naval Air Rework Facility and assigned to a Weapon Systems Manager (WSM) under the NAVAIRSYSCOM Model Management program. The Model Management concept effectively decentralizes the management of a weapon system from NAVAIRSYSCOMHQ to a field office with an equivalent Project Manager, Project Deputy, Class Desk, APML, and other staff managers. The Model Management program is still a matrix organization since the various functional groups at NAVAIRSYSCOMHQ and Field Activities have the responsibility to provide support to the program when required.

D. GENERAL SYSTEMS THEORY

A system may be defined as a group of elements or subsystems exhibiting a set of interrelationships and interacting together toward one or more goals and objectives [Alexander, P. 4].

One way to define an organization is by the use of an appropriate systems model. Systems theory states that an organization open to outside influence, such as weapon systems management within the Naval Air Systems Command, can be represented by a dynamic open systems model. Such a model is shown in figure 2-6. The basic model consists of inputs, a processor and controller, and outputs with feedback. The processor transforms the inputs into outputs in accordance with the operating rules of the controller. The feedback path indicates that the inputs are influenced by the outputs. A simple illustration of this process is as follows: Assume that the NAVAIRSYSCOM weapon systems management organization receives input funding for research and development whereby it processes the funding by contracting for the effort. If the output is an acceptable weapon system design, this in turn provides feedback that will influence the type and amount of input funding received for the next phase of the program such as full scale development.

Figure 2-7 represents an expanded version of the basic model in which the processor and controller are represented by the following subsystems: Organizational Variables, Task Attributes, Informal Social System, and Human Dimensions [Dean]. This model has been further expanded and refined into a Systems Analysis Model for use in defining the NAVAIRSYSCOM weapon systems management organization in Section IV.

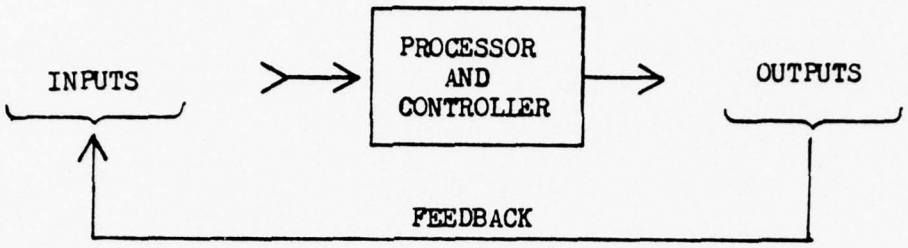


FIGURE 2-6

BASIC DYNAMIC OPEN SYSTEMS MODEL

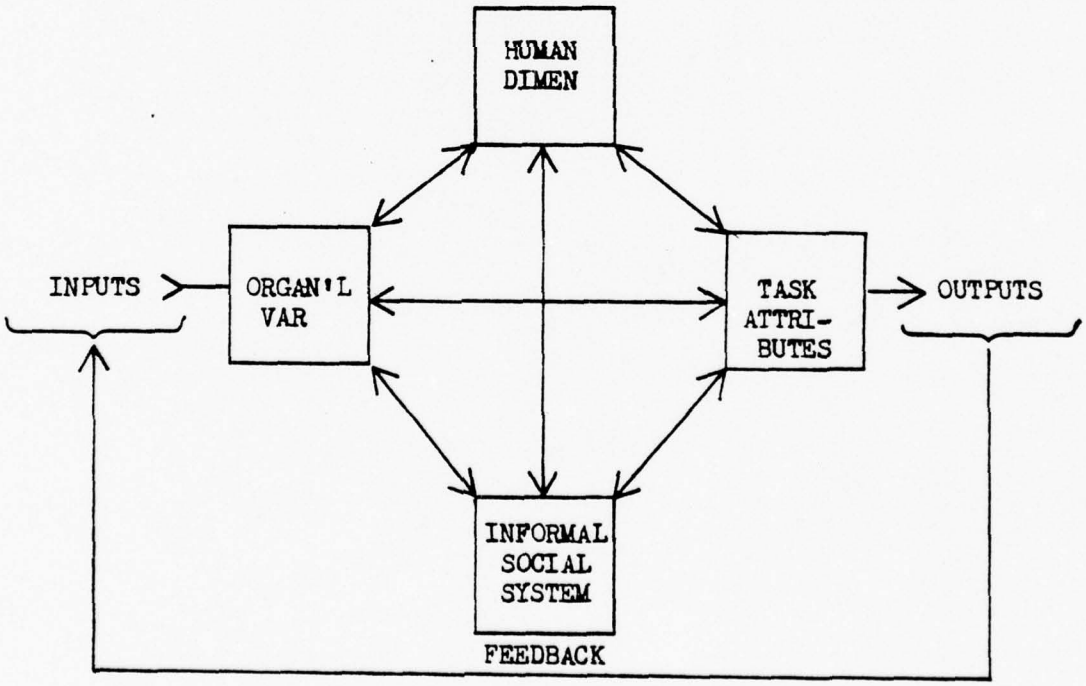


FIGURE 2-7

DYNAMIC OPEN SYSTEMS MODEL OF AN ORGANIZATION

E. ORGANIZATIONAL DIAGNOSIS THEORY

In order to diagnose an organization, it must first be defined. One way to accomplish this is to view the organization as (1) a set of functional or divisional strategies, (2) a set of personal strategies, (3) a set of personal abilities, and (4) a set of relationships [Uyterhoeven, Ackerman, and Rosenblum, P. 73].

In terms of the weapon systems management organization within NAVAIRSYSCOM, the above characteristics were identified as the (1) Operational Requirements, and (2) Abilities and Assets of the organization.

The Operational Requirements were the Mission/Goals and Responsibilities of the organization as defined in the Systems Analysis Model in Section IV under Task Attributes.

The Abilities and Assets were the Model Inputs, Outputs, Organizational Variables, Informal Social System, and Human Dimensions.

Once the organization has been defined, its adequacy must then be evaluated to complete the diagnosis. The test of adequacy determines the organization's (1) capability to support corporate strategy, (2) capability to meet environmental threats, and (3) capability to discharge its key operational requirements [Uyterhoeven, Ackerman, and Rosenblum, P. 76].

Relating these tests of adequacy to the NAVAIRSYSCOM weapon systems management organization simply means an evaluation to determine if the Abilities and Assets of the organization are sufficient

to accomplish its Operational Requirements. The procedure used in this evaluation is described in more detail in Section III.

F. SUMMARY

This Section has attempted to provide the basic background considered essential to a full understanding of the study.

A brief review of the history of Weapon Systems Management reveals that it evolved to meet the demands of large complex programs with the Department of Defense in an environment of accelerated technology and urgent schedules.

Further investigation shows that there are three basic organizational arrangements utilized by Weapon Systems Management: (1) Functional Organization, (2) Project Organization, and (3) Matrix Organization. Each organizational arrangement has its advantages and disadvantages. The Matrix organization is an attempt to utilize the best features of both the Functional and Project Organization.

An analysis of Weapon Systems Management required a basic comprehension of certain life-cycle management concepts that were presented in this Section. It was found that the management life-cycle of a weapon system could be divided into three distinct phases: (1) Pre-Production, (2) Production, and (3) Out-of-Production. The requirements to manage each phase were found to be significantly different.

Systems theory states that a management organization open to outside environmental influence can be represented by a dynamic

open systems model. The Systems Analysis Model utilized in Section IV to define the NAVAIRSYSCOM Weapon Systems Management organization was developed from a basic dynamic open systems model.

Organizational diagnosis theory states that diagnosis begins with the definition of the organization's basic operational requirements and its abilities and assets. An evaluation must then be made to determine the adequacy of the organization's abilities and assets to accomplish its basic operational requirements. The procedures utilized in this study in Section V to evaluate the NAVAIRSYSCOM Weapon Systems Management Organization followed this basic process.

III. PROCEDURE

A. COLLECTION OF DATA

The basic source of data for this study was from practicing Project and Weapon Systems Managers and their staffs. Interviews were held with thirty-five experienced project personnel from twenty out of the approximately thirty total Project and Model Management offices at NAVAIRSYSCOMHQ and various Field Activities. The interviews consisted of general discussions about organizational design, short and long term goals, management problems, recommended improvements, and a ranking of basic elements considered essential to effective project management. Refer to the Interview Outline in Appendix A. Additional data was also collected from review of applicable Defense Department directives and instructions.

B. ORGANIZATIONAL DEFINITION

The problem of how to best present the collected information in an organized format to define the management organization was accomplished by the use of a Systems Analysis Model. The model was developed by tailoring a general dynamic system model to the NAVAIRSYSCOM Weapon Systems Management situation.

The three life-cycle phases of Weapon Systems Management, as described in Section II, were then defined in terms of the model's subsystems in order to provide an inventoried data base for the following

organizational evaluation.

C. ORGANIZATIONAL EVALUATION

Two distinct Weapon Systems Management organizations were defined, Project Management and Model Management. There were four basic steps used to evaluate the Project and Model Management organizations. These are illustrated in figure 3-1 and described as follows:

1. The first step consisted of reviewing the organization's characteristics in terms of its operational requirements and its abilities and assets to accomplish those requirements. The organizational characteristics from Section IV were summarized and presented in table format in Section V.

2. The second step was a review of the management problems reported in the interviews. This gave key insight regarding deficiencies in the organization and was used along with the other data in determining organizational adequacy.

3. The third step was a review of the ranking results of the essential elements to effective Project and Model Management. This gave important insight regarding the relative degree of significance Project and Weapon Systems Managers placed on certain assets. This information was used to substantiate the evaluation results.

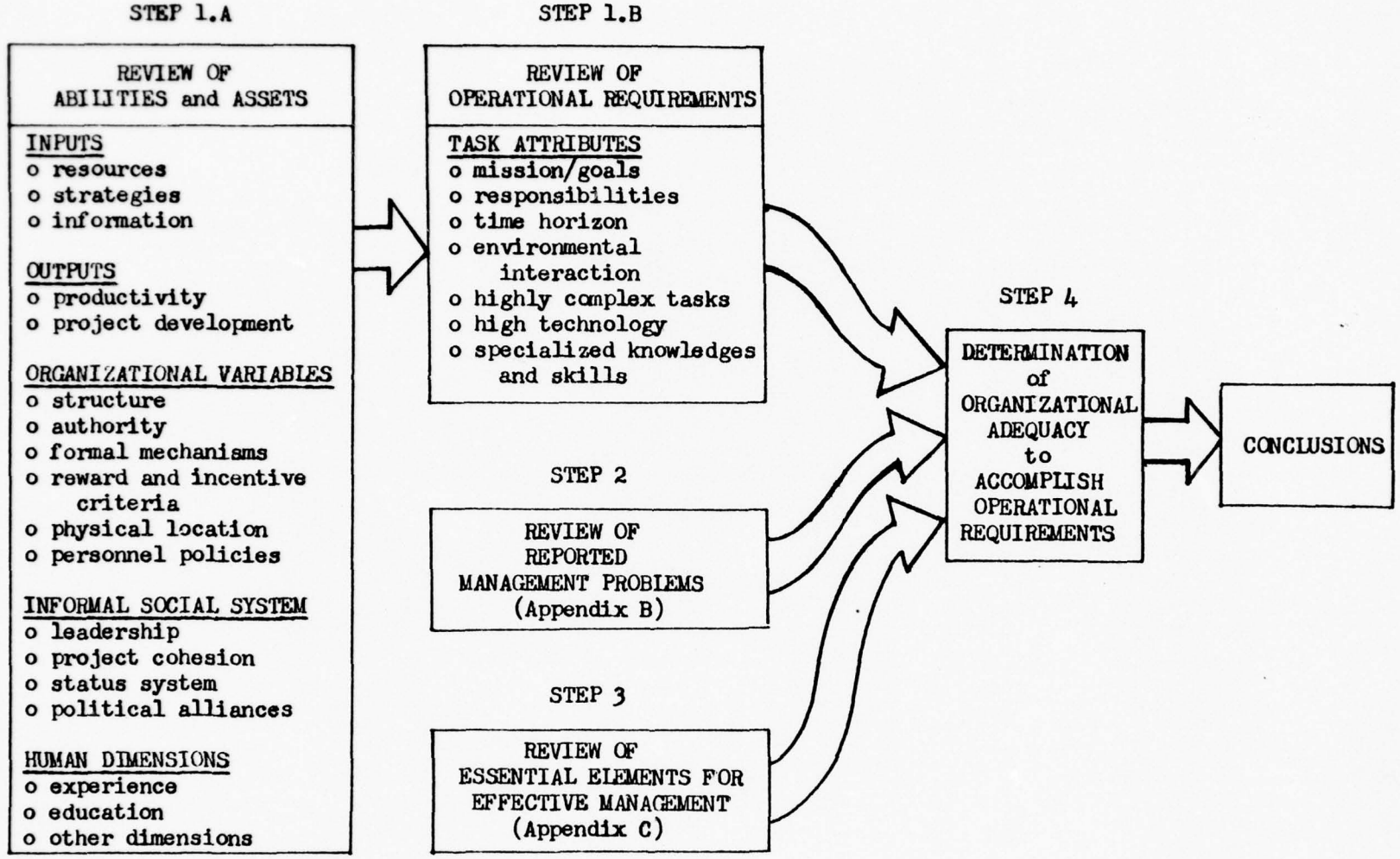


FIGURE 3-1

FLOWCHART SHOWING METHOD OF EVALUATING THE ORGANIZATION

4. The fourth step was an evaluation to determine the organization's adequacy to accomplish its operational requirements. Resulting conclusions were reached based upon information reviewed in the first three steps of this evaluation.

IV. ORGANIZATIONAL DEFINITION

A. SYSTEMS ANALYSIS MODEL

Section II discussed some general systems theory and presented a simplified model for use in this organizational analysis of NAVAIR-SYSCOM Weapon Systems Management. In addition, the three life-cycle phases of a weapon system (1) Pre-Production, (2) Production, and (3) Out-of-Production, were presented. Section III described the planned methodology of the analysis whereby organization definition was first achieved through the application of this model. The model served as an inventory of various aspects of each management life-cycle phase. Because of the complexity of the management situation involved, however, only those sub-system elements of the model considered pertinent to the purpose of this study were emphasized with brief comment on those elements of lesser significance. Once the organization was defined, it was then evaluated in terms of its adequacy to meet strategic goals, defined problems, and in terms of those elements considered essential for effective management.

Figure 4-1 illustrates the Systems Analysis Model used to define the Weapon Systems Management organization [Adapted from Dean]. Its inputs, outputs, and subsystems were defined as follows:

1. Inputs

   a. Resources

   b. Strategies and Plans

   c. Information

2. Outputs

   a. Productivity (various measures)

   b. Project Development

3. Organizational Variables

   a. Structure

   b. Authority

   c. Formal Mechanisms (SOP's)

   d. Reward and Incentive Criteria

   e. Physical Location

   f. Personnel Policies

4. Task Attributes

   a. Goal Orientation

   b. Risk and Uncertain Events

   c. Time Horizon

   d. Environmental Interaction

   e. Highly Complex Tasks

   f. High Technology

   g. Specialized Knowledges and skills

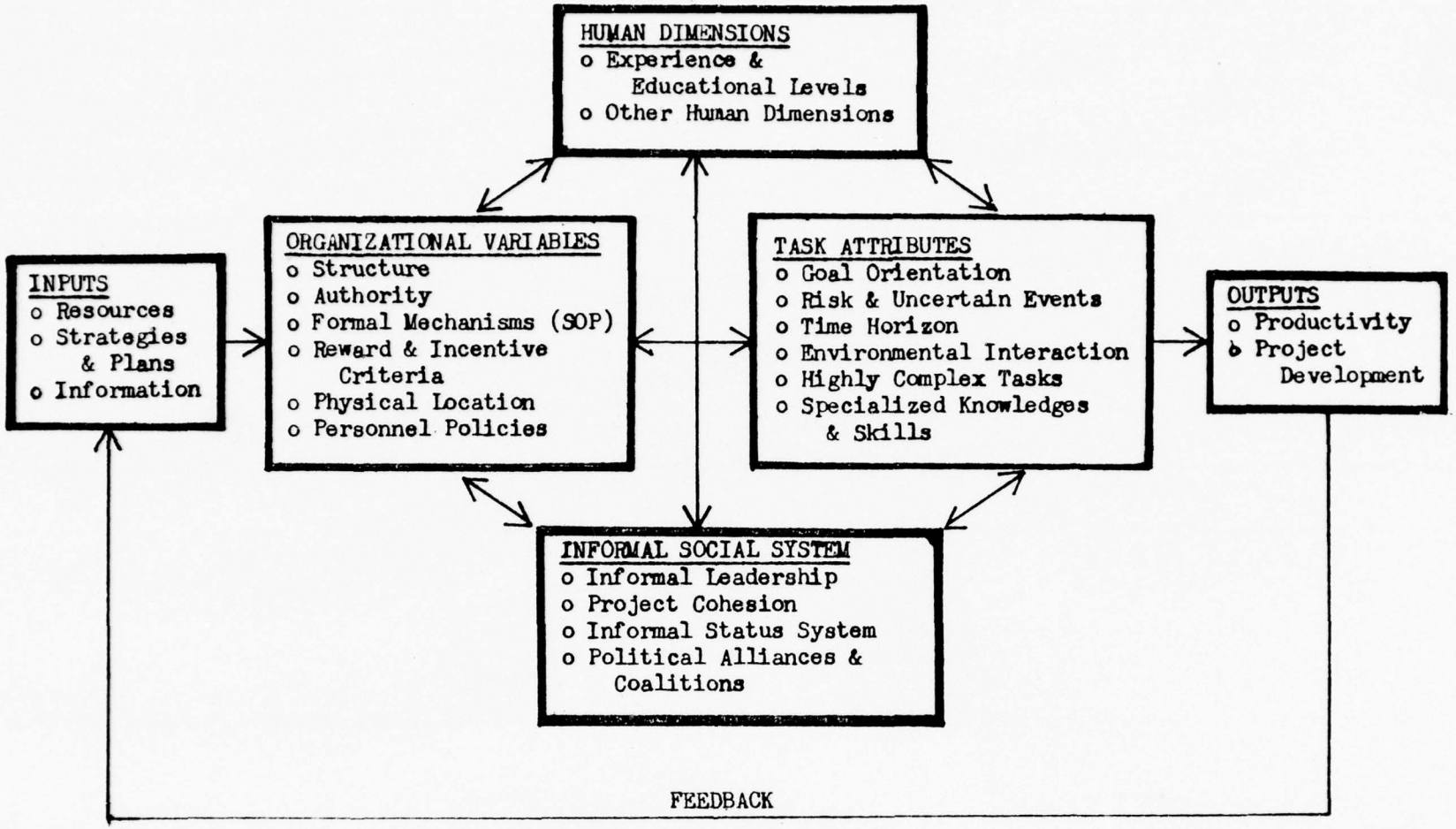


FIGURE 4-1

SYSTEMS ANALYSIS MODEL

5. Informal Social System

a. Informal Leadership

b. Project Cohesion

c. Informal Status System

d. Political Alliances and Coalitions

6. Human Dimensions

a. Experience and Educational Levels

b. Other Human Dimensions

B. SYSTEMS ANALYSIS OF LIFE-CYCLE MANAGEMENT PHASES

1. Inputs

a. Resources

(1) People. During both the Pre-Production and Production Phases, major projects are normally headed up by a CNO chartered Project Manager, Aircraft (PMA), and minor projects by a NAVAIRSYSCOM designated Aircraft Project Coordinator (APC), as defined in Appendix D. Because of the matrix organization used by the Navy, the number of people on a typical NAVAIRSYSCOM project office staff is relatively small especially when one considers the large degree of technical, managerial, and financial responsibility assumed. For example, a small project may have as little as five or six people while the largest project will usually have no more than 25 or 30 people. The project office staff will usually consist of one or more military and/or civilian deputies and their assistants for such areas as fiscal

control, planning, air vehicles, weapons, logistics support, foreign military sales, etc. The support groups to the project office consist of the Contracting Officer, Comptroller, a Class Desk, Assistant Project Manager for Logistics (APML), and their respective support teams in the functional areas at NAVAIRSYSCOMHQ and Field Activities.

The project office normally is disestablished following the completion of the last production contract, and the APML assumes the lead management responsibility for the weapon system. The participating managers in the functional areas continue to support the program, although by this time they may have been assigned to also support newer weapon systems. At some point in time (since January 1973) during the Out-of-Production Phase when the management of the weapon system becomes more stable, the project is normally assigned to a Weapon Systems Manager (WSM) at a Field Activity under the NAVAIR Model Management Program. The Model Management Office is normally staffed by the WSM, a Deputy Manager, Class Desk, APML, and/or other specialized engineering and logistics managers. The matrix organization is still utilized since Participating Managers in the functional areas at NAVAIRSYSCOMHQ and Field Activities are called on by the model management office to support the weapon system when required.

Other project related groups that provide inputs to the project office are identified in figure 4-2 and includes Congress,

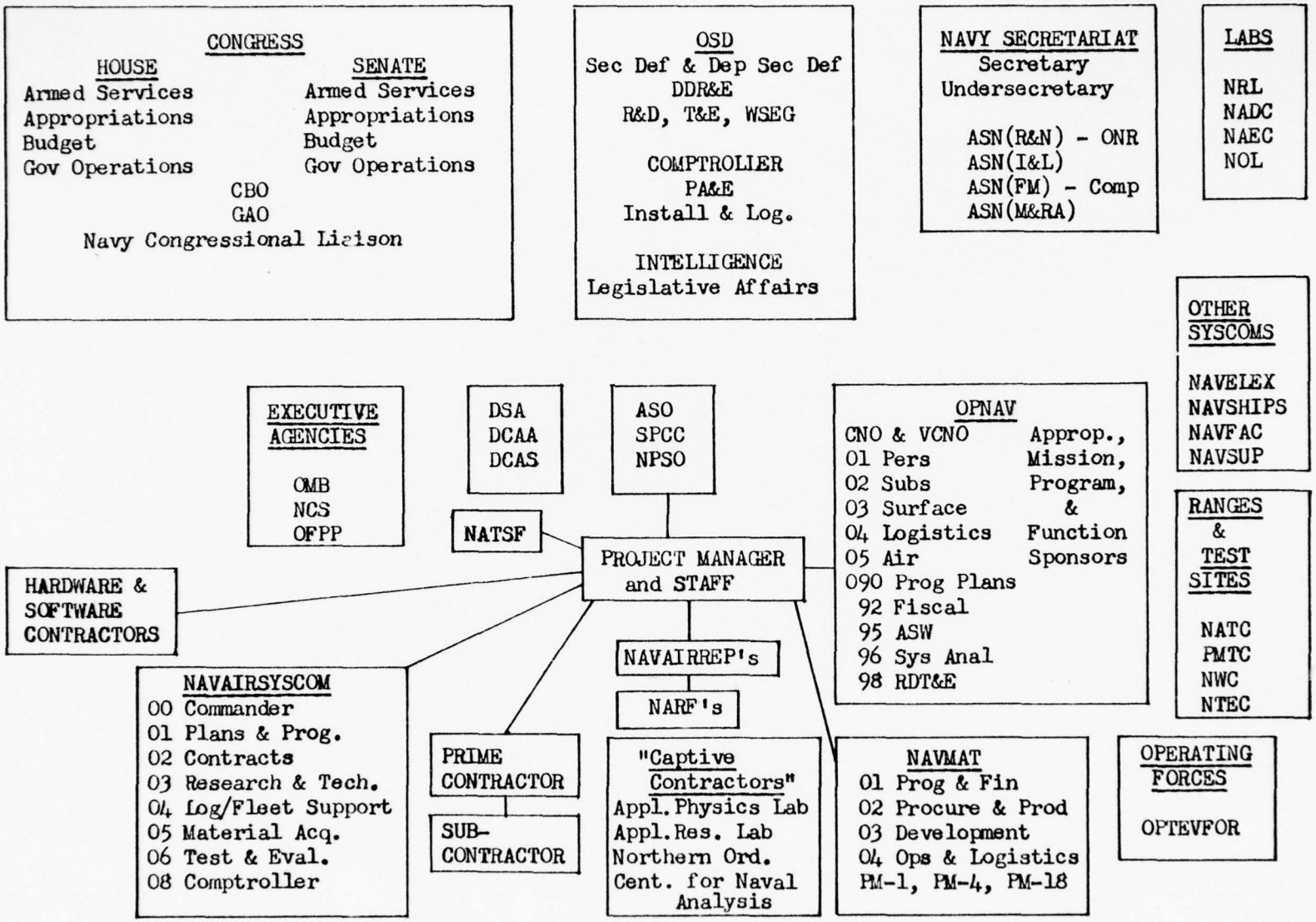


FIGURE 4-2

COLLECTION OF VARIOUS AGENCIES/GROUPS THAT INTERACT WITH THE NAVAIRSYSCOM PROJECT OFFICE

Executive Agencies, contractors, the Fleet, OSD, SECNAV, CNO, CNM, Laboratories, Test Facilities, and various Field Activities.

(2) Funding. The Pre-Production Phase involves the budget formulation, administration, execution, and expenditures of primarily RDT&E funds. Also during the Pre-Production Phase approximately 2-1/2 years prior to the DSARC/NSARC III milestone, new procurement APN-1 (or WPN and sometimes OPN and SCN) funds must be budgeted to support the production contracts in the next phase of the project life cycle. By definition (DOD DIR 5000.1), the anticipated funding expenditures of a major project exceeds $75 million for RDT&E and $300 million for procurement. The PMA/APC has financial control of his budget during this phase although he must continually justify and defend them to higher authority to prevent them from being cut.

In addition to the new procurement funds that are being expended during the Production Phase, there are other types of out-of-production support funds that must be budgeted (approximately 2-1/2 years leadtime required) such as APN-5, APN-6, APN-7, and O&MN funds. These out-or-production funds are needed to support the weapon system when it becomes operational in the Fleet. Neither the PMA/APC nor WSM have administrative control over these out-of-production funds. They are, however, responsible for providing budgetary inputs for support of their project to the designated budget

administrator (Requiring Manager). In contrast to the project administration of RDT&E and initial procurement funds for a particular weapon system, the out-of-production funds are normally managed within NAVAIRSYSCOM by designated budget administrators (Requiring Managers) in the functional areas who have to support all operational weapon systems. AIR-4144, for example, administers O&MN funds for rework of aircraft and missiles. Modifications to out-of-production aircraft weapon systems are funded by the Operational Safety Improvement Program (OSIP). AIR-1041 is responsible for administering OSIP APN-5 funds.

(3) Facilities. Facilities normally available to the weapon system project during all three phases include contractor's plants and the various in-house Navy facilities such as Navy Research and Development Laboratories, Test and Evaluation Facilities, Naval Air Rework Facilities, etc. Use of these facilities, however, is almost always dependent upon the availability of project funds to pay for their services. This is a severe handicap to older projects, especially after the systems have gone out-of-production and support funds are extremely scarce or non-existent. For example, there may be an operational need to redesign a particular component installation on an out-of-production aircraft to improve or extend its overall performance as a system. The lack of available funding to perform the required test and evaluation and follow-up engineering design

might delay for several years or prevent altogether any corrective action.

b. Strategies and Plans

Input strategies and plans to the project are primarily the result of direction from higher authority. Many of these are formalized and published in various documents. However, the personal strategies of the Project or Weapon Systems Manager and his staff must also be considered. It is important to note that the input strategies to the project should be congruent with the Goal Orientation (Task Attribute) and the Formal Planning Mechanisms (Organizational Variable) of the project. Input strategies and plans are contained for the most part in the following sources:

(1) Project Charter and Model Management Instruction. The project charter establishes the mission, authority, and responsibility of the Project Manager during the Systems Acquisition Cycle, which includes both the Pre-Production and Production Phases of the project. The Model Management Instruction, NAVAIRINST 5400.70, does the same for the Weapon Systems Manager during the Out-of-Production Phase. In addition, the project scope, operating relationships, procedures, organization, and resources are defined.

(2) Integrated Logistics Support Plan. During the early phases of the project, the APML has developed an Integrated Logistics Support (ILS) Plan which defines the logistics support strategy and

plans for the duration of the project. The Weapon Systems Manager continues with this plan and revises it accordingly to meet changing program requirements.

(3) DOD Component Directives and Instructions. Examples: DOD DIR 5000.1 and SECNAVINST 5000.1 (as revised by OMB Circular A-109) establish the policies, strategies, and management principles for systems acquisition.

(4) CNO Strategies, Carrier Deployment Schedules, and Weapon Systems Planning Document (WSPD). Example: OP-05, OP-506, and Type Commanders establish aircraft force level mixes and carrier deployment dates which are reflected in the WSPD and Carrier Deployment Schedules.

(5) Congressional Strategies. Example: Authorization of funding for specific aircraft force levels.

(6) Personal Project Manager Strategies. Individual strategies of each PMA/APC or WSM to defend, justify, and support his project.

c. Information

The following include various sources of information available to the project office:

(1) Management Information Systems. Examples are: 3M data, Unsatisfactory Reports (UR's), Readiness Improvement Status Evaluation (RISE), Contract Progress Repprts, and Cost/Schedule Control Systems.

(2) Reports. Examples are: test, performance, and field type reports.

(3) Meetings and Conferences. Examples are: congressional committee meetings, DSARC/NSARC, Integrated Logistics Support (ILS) meetings, design review meetings, etc.

2. Outputs

a. Productivity (various measures)

(1) Accomplishing Milestones. During the Pre-Production and Production Phases of the weapon system, various formal programs are normally in effect which have established milestones. One of the measures of productivity by which the Project Manager is judged is how well these milestones are met relative to schedule and performance. Some examples of these milestones are DSARC/NSARC 0, I, II and III, SAR milestones, and Fleet Introduction. Other milestones to be met after the weapon system has been deployed and after the system has gone out-of-production are: Integrated Logistics Support (ILS) milestones for support in meeting designated carrier deployments, and various milestones involved in updating selected component systems of the weapon system such as in a Conversion in Lieu of Procurement (CILOP)/Service Life Extension Program (SLEP).

(2) Budget Management. Another measure of productivity is in the area of budget management. The Project Manager is responsible for planning, programming, and, when appropriate, reprogramming of project funds. The project office is also responsible for budget

justification, execution, and control. Sometimes, new or unbudgeted requirements materialize and the need for additional funds must be justified to higher authority. The success of the overall project is usually determined by how well the Project Manager and his staff can defend and manage his budget. During the Out-of-Production Phase, the available funds to the weapon system are normally managed by designated budget administrators (Requiring Managers) in the functional areas of NAVAIRSYSCOMHQ. Although the APML or the designated WSM does not normally have budgetary control over out-of-production funds, they are responsible for providing program budgetary inputs to the designated budget administrator.

(3) Weapon System Design Performance. One of the primary goals of the project during the Pre-Production Phase is for the weapon system to meet its designed performance relative to operation, reliability, and maintainability. Upon completion of engineering development, the new weapon system's operational performance must be certified for servise use as evidenced by Board of Inspection Survey (BIS) acceptance. Although this is a DSARC/NSARC III milestone prior to authorization for production, quite often BIS trial discrepancies are waived in order to meet Fleet commitments with the intent of correcting them concurrently with initial production. Problems with maintainability and reliability of the system do not normally surface until after the systems are introduced to the Fleet and they are deployed.

How well the weapon system meets its designed performance is a direct reflection on the quality of specifications, type of contract, availability of funds, and quality of management during the early phase of the acquisition process.

(4) Weapon System Readiness (Logistics Support). Although the actual logistics support does not occur until after Fleet introduction, the APML has the responsibility during the early part of the Pre-Production Phase to develop a viable integrated logistics support plan and ensure that his logistics requirements are an input to the early systems design. Again, the readiness of the weapon system after deployment is also a direct reflection on the quality of management and planning during the early phase of the acquisition process.

The logistics support problems occur, however, after the weapon systems have actually been deployed, and especially during the Out-of-Production Phase. During this phase, the measures of project productivity are: responsiveness to urgent Fleet problems; material support (components and spare parts); technical manual support; support equipment; aircraft and component rework; maintenance engineering support; and support to shipboard interface requirements. Some Project Managers contend that the biggest payoff in aircraft readiness is in the area of Integrated Logistics Support (ILS).

b. Project Development (Growth or Decline)

(1) Actual Expenditures. One measure of the development of a project is in the growth or decline in fund expenditures.

Typically, however, the RDT&E expenditures are the greatest during the Concept Formulation or early part of the Pre-Production Phase, and they taper down during the Contract Definition or latter part. With the start of the Production Phase, new procurement expenditures are the greatest as a result of the new production contract. Follow-on procurements may show an increase or decrease in expenditures, depending on the size of the buys. After the weapon system goes out-of-production, the total expenditures normally decline since procurements are confined to modification kits, spare parts, support equipment, technical manual, and data package updates. Also, out-of-production modification funds are scarce and must be competed for between all out-of-production weapon systems. The expenditure of funds on an older weapon system may again increase however, by a Conversion in Lieu of Procurement (CILOP)/Service Life Extension Program (SLEP).

(2) Size and Rank of Project Staff. Typically, the number of personnel assigned to a project starts off small and grows as the project develops. The rank of the Project Manager and his staff quite often will increase as the size and importance of the project increases. The project size will normally peak during the latter part of the Pre-Production Phase and carry over into the Production Phase where it gradually declines until completion of the last production contract, and the project office is disestablished. The project takes

on new vitality again when a Weapon Systems Manager is assigned and a Model Management office is established at a Field Activity.

It would be a wrong assumption, however, to believe that the size of a project staff is solely dependent on the task requirements during any particular phase. Although that is perhaps the way it should be, most often the number of personnel assigned to a project is representative of the Project or Weapon Systems Manager's ability and success in selling his personnel requirements to his Command in an austere environment.

3. Organizational Variables

a. Structure

Weapon Systems Management with NAVAIRSYSCOM is based upon a matrix organization as described in Section II. During the Pre-Production and Production Phases, the Project Manager and his staff serve as the focal points for all inputs and outputs of the project. The Project Manager's position is established within NAVAIRSYSCOM but he reports directly to his CNO sponsor (Program Coordinator) in OP-506. The Project Manager and his staff, however, are dependent upon support from the functional areas to carry out project requirements. The Class Desk (AIR-510) has the lead responsibility for basic design engineering on the weapon system and leads a team of engineers from other functional areas in NAVAIR and various Field Activities. Likewise, the APML (AIR-410) has the lead responsibility for Integrated Logistics Support (ILS) and leads his team of

participating logistic managers in functional areas of NAVAIR and various Field Activities. Each project office is structured somewhat differently, depending on the project size and individual requirements. The project charter defines the structure and operating relationships between the various organizational areas. The organizational relationships between the various project related managers is illustrated in figure 4-3.

After the system goes out-of-production and the project office has been disestablished, the support of operational weapon systems in the Fleet is dependent upon the various functional managers at NAVAIRSYSCOMHQ and designated Field Activities under the lead of the APML. The Class Desk, who still has the lead responsibility for basic design of the weapon system, normally responds when the APML, his team, or the Fleet report a logistics problem related to configuration. Most APML's, Class Desks, and Participating Managers in the other functional areas, have more than one weapon system to support.

A Model Management office and Weapon Systems Manager will normally be assigned the project at a Field Activity after the program stabilizes and becomes less volatile. The Weapon Systems Manager and his staff are administratively assigned to the Field Activity Command where they are physically located, and functionally assigned to COMNAVAIRSYSCOM via AIR-04. Like the project offices,

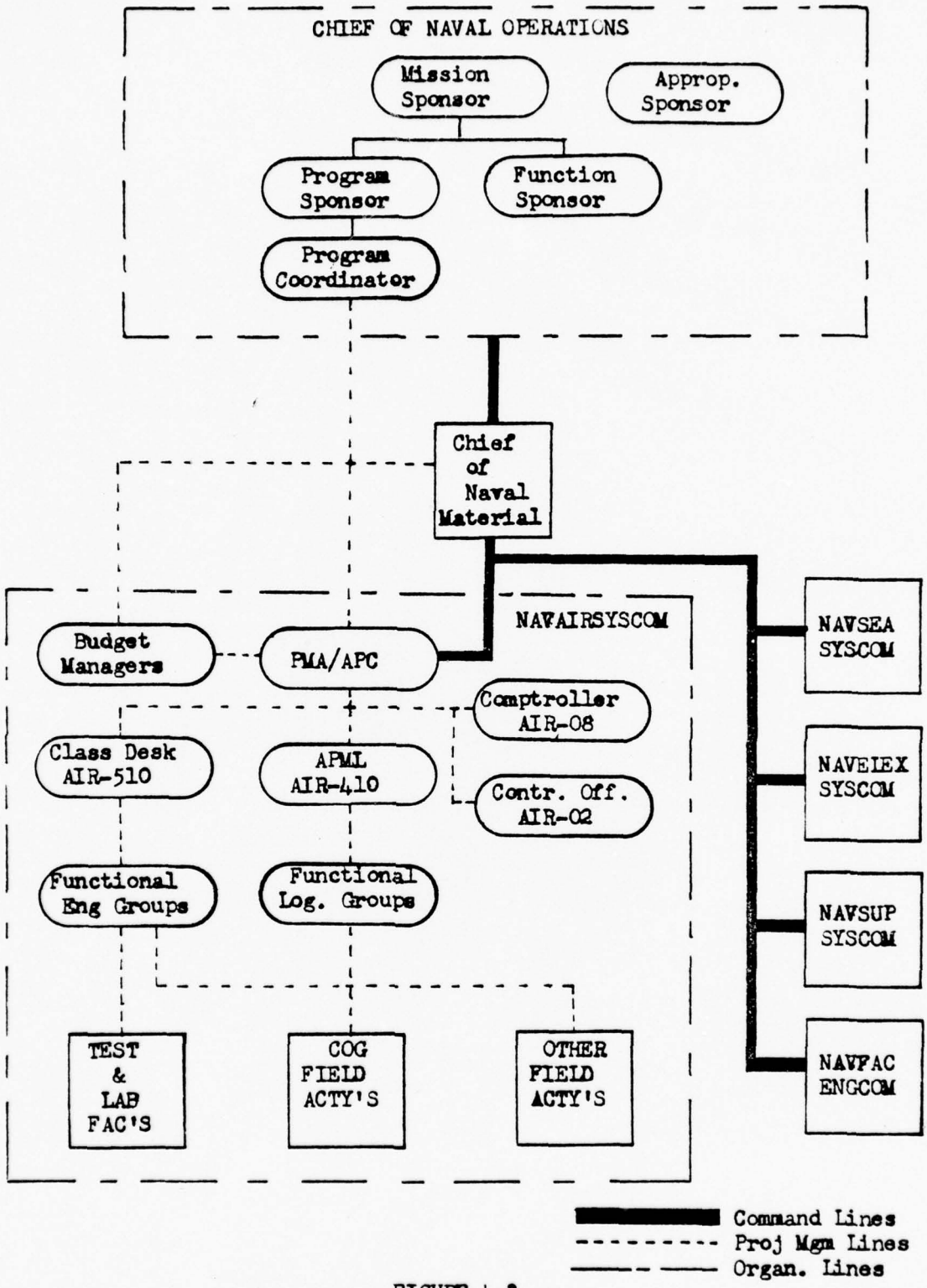


FIGURE 4-3

ORGANIZATIONAL RELATIONSHIPS BETWEEN VARIOUS PROJECT RELATED MANAGERS OF AN AIRBORNE WEAPON SYSTEM

the structures of the Model Management offices varies from one project to another. The larger Model Management offices, however, have a Weapon Systems Manager, a Deputy Manager, an APML, a Class Desk, and other specialized engineering and logistics managers. In some cases, a Financial Analyst is employed to manage funding on special projects.

b. Authority

In a matrix organization, the Project or Weapon Systems Manager cannot operate effectively if he relies solely on his formal authority. His success is more likely to depend on his capability to build alliances and influence other organizational members.

The formal authority of the Project Manager is defined in the project charter. He is the single central executive responsible for the successful management of the project toward accomplishment of its objectives. He has broad directive authority over project planning, direction, control, and utilization of resources and over project efforts of in-house and contractor organizations. As the responsible executive, he is expected to act on his own initiative in matters affecting the project. The Project Manager is assigned the specific authorities set forth in SECNAVINST 5000.1.

During the Out-of-Production Phase, the management of the weapon system is initially assumed by the APML and later on by a Weapon Systems Manager. The management authority is no longer

defined by specific charter but collectively with other out-of-production systems by NAVAIRINST.

The project authority for the APML is defined in NAVAIRINST 5000.8. He is the principal member of his functional group for Logistics Fleet Support. After the project office is disestablished, he carries the authority of a Project Manager and is the focal point for direction of all efforts concerning Integrated Logistics support of the weapon system. He is responsible for planning, liaison, and execution of an Integrated Logistics Support Program within his functional group.

The project authority for the Weapon Systems Manager is defined in NAVAIRINST 5400.70. The extent of his authority is essentially the same as that of a Project Manager in that he is the primary executive responsible for overall management of a weapon system. However, the scope of his authority is primarily limited to logistics management and support of an operational system in the Fleet. A serious limitation to his authority is that he does not have financial control over funds budgeted for his project. The Weapon Systems Manager also does not have AIRTASK sign-off authority although he is responsible for planning and executing efforts at various Field Activities in support of his program (such as test and evaluation programs) which are normally directed by AIRTASK.

c. Formal Mechanisms (SOP) for Planning and Goal Setting

These mechanisms for the Pre-Production and Production Phases are defined in the project charter and in various DOD Component Directives and Instructions. OMB Circular No. A-109 has recently made significant changes to the formalized systems acquisition process. Some examples of these formal mechanisms are: Planning, Programming, Budgeting System (PPBS) related documents such as JSOP, JFM, POM; and other important mechanisms such as: DCP, DSARC/NSARC, WSPD, ASPR, and Carrier Deployment Schedules.

During the Out-of-Production Phase, the formal planning mechanisms are mostly defined in DOD Component Directives and Instructions. The POM, WSPD, and Carrier Deployment Schedules are still important planning documents for this phase. One of the more important planning documents for the Out-of-Production weapon systems is the Integrated Logistics Support Plan (ILSP).

Other less formal planning mechanisms frequently used during all phases of the project include instruments such as Transition Agreements and Memorandums of Understanding.

d. Reward and Incentive Criteria

These include fitness reports for military officers assigned to the project and performance evaluations for civilian employees. The fitness report of the Project Manager is normally signed by the Commander of the Naval Air Systems Command and those of his staff by the

Project Manager himself. Once the project has been assigned to a Field Activity, the designated Weapon Systems Manager receives a regular fitness report from the Field Activity Commanding Officer. However, the practice of providing a concurrent fitness report from NAVAIRSYSCOM (AIR-04) in accordance with NAVAIRINST 5400.70 has been terminated. This tends to create problems when there are conflicts between program priorities and those of the Field Activity to which the Weapon Systems Manager is assigned. When this happens, the Weapon Systems Manager ceases to manage his program in an objective manner since the priorities established by the Field Activity Commanding Officer are not necessarily congruent with program requirements.

One problem typical of a matrix organization is that individual fitness reports and performance evaluation for Participating Managers in the functional areas are normally appraised within the functional groups rather than by the Project Manager whom they support. Current plans, however, are to include the Project Manager in the performance evaluation process.

An interesting concept to note is the incentive criteria that a Project Manager has to maximize his budget rather than to minimize it. Because of the highly competitive system for justifying project funds, no Project Manager ever gets rewarded for minimizing his budget. His rewards do come however, from all of the good things that he can do for the project such as meeting critical project milestones,

minimizing basic design and logistics problems to improve systems readiness, and maximizing the number of performance and reliability improvement changes. All of these things are obviously easier to accomplish with a large budget.

e. Physical Location

During the Pre-Production and Production Phases, the project office is normally located at NAVAIRSYSCOMHQ, which is in the greater Washington DC area. This is important because the majority of agencies that the project office frequently interacts with are also convenient to the Washington area. For example, it is not uncommon for the Project Manager and his staff to be called to the Pentagon several times in one day for budget meetings. In addition, many of the functional managers on the project team are centrally located in Washington, although this pattern is recently changing with the emphasis on relocating many support groups to Field Activities.

During the Out-of-Production Phase, the project is assigned to a Weapon Systems Manager and physically located at a Field Activity such as a Naval Air Rework Facility (NARF). The choice of the location is usually an extension of an earlier one to designate the same Facility as the Cognizant Field Activity (CFA) for basic design and maintenance engineering responsibility. Frequently, the same Facility will also be the prime Designated Overhaul Point (DOP) for the weapon system. Since the majority of problems on out-of-production weapon systems

are logistics in nature, project management is enhanced by centrally locating the WSM, CFA and DOP at the same Field Activity.

f. Personnel Policies

Navy military officers are normally relocated every two or three years in most Commands. This obviously can be a disruption and loss of continuity to a project, especially if allowed to occur during a critical phase. For this reason, it is frequent policy for Project Managers and their military staff to serve extended tours while assigned to a project. In addition, the Weapon Systems Acquisition Management (WSAM) Program, as defined in BUPERSINST 1040.2, establishes formalized training and selection criteria for military project personnel. Also, DOD Directive 5000.1 addresses the assignment and tenure of Project Managers by requiring career incentives be established to attract, retain, motivate, and reward competent Project Managers. Changes in Project Managers are not supposed to be made prior to Milestone I or during full-scale engineering development prior to the Milestone III decision, except by specific action of higher authority. The WSAM Program and DOD Directive 5000.1 do not address civilian or Model Management personnel.

4. Task Attributes

a. Goal Orientation

The Project Manager's primary mission is to provide to the operating forces of the Navy fully supported weapon systems which

will satisfy approved operational requirements. The scope of the projects consists of concept formulation, contract definition, development, test and evaluation, acquisition, and initial support of the weapon system. This includes subsystems and components, spares, repair parts, special and general support equipment, weapon system trainers/flight simulators, and all supporting technical documentation. These requirements are clearly identified in the project charter and in various DOD Component Directives and Instructions.

After the weapon systems have been deployed in the Fleet, the primary mission of the project is maintaining aircraft readiness.

Some time after the project office has been disestablished, a Weapon Systems Manager is designated at a Field Activity. The WSM is the principal advisor, consultant, and manager of the weapon system for the Commander of NAVAIRSYSCOM. He is responsible for overall management of the weapon system to satisfy requirements of CNO and the Fleet. He also serves as a point of contact and acts in an advisory capacity to other services, agencies, and foreign governments. This includes management responsibilities for: planning and execution of total systems integration; design and maintenance engineering; modifications and improvements; maintenance and rework; testing and evaluation; configuration control; material acquisition; contracting; coordination of interservice programs; and logistics support to the Fleet in the areas of spares and repair parts, rework programs, training, facilities,

PGSE, contractor or Navy technical services, and technical documentation. These requirements are defined in NAVAIRINST 5400.70.

Another important task of Project and Weapon Systems Management is in the Foreign Military Sales Program where management services of systems acquisition and integrated logistics support are provided to a foreign government in very much the same or similar fashion that services to our own Government are provided.

b. Risk and Uncertain Events

The task of project management is one of risk and uncertainty to which the project team must continually respond. For example, during the Pre-Production Phase, the project is faced with the uncertainties of research and design development; test and evaluation; safety, reliability, maintainability considerations as related to basic design; and the continually changing strategies from higher authority concerning program requirements such as aircraft procurement numbers and configuration requirements.

During the Production Phase, the project is faced with the new uncertainties of contract performance and initial Fleet introduction.

During the Out-of-Production Phase, the uncertain aspects of maintainability and reliability and their impact on systems readiness must be addressed.

c. Time Horizon

One aspect of the project management task that significantly complicates the planning problem is the requirement to meet fixed

deadlines regardless of continually changing program inputs. For example, once the decision is made from higher authority regarding a specific carrier configuration and deployment date, an all out effort must be made to meet that deadline. When unforeseen problems or changes in the program occur, compressed schedules and work-arounds must be generated in order to provide the required support to the carrier when it deploys. The Project Manager is responsible for providing urgent response to Fleet problems, briefings to higher echelons, program justification, and, of course, any crisis involving National Defense concerning his project. The above is true for all phases of the project.

d. Environmental Interaction

Figure 4-2 is a survey of the main agencies and groups that interact with the Project or Weapon System Manager, his staff, and team members in performing their task. The list includes, but is not limited to: upper DOD echelons such as CNM, CNO, SECNAV, SECDEF, OMB; various Field Activities such as the Laboratories, Test and Evaluation Facilities and Naval Air Rework Facilities; Congressional Committees; Contractors; other System Commands; and the Fleet.

e. Highly Complex Tasks

When one considers the large number of agencies and outside influences the project office must constantly interact with (refer to figure 4-2), the multitude of organizational requirements, and

resulting variables that are part of the bureaucratic government system, the task of managing the project can only be classified as highly complex. Although the nature of the tasks change as the system evolves through its life cycle, the complexity of the tasks do not.

f. High Technology

The technology involved in the project management task should also be classified as advanced and rapidly changing, especially in the Electronics and Aerospace fields. Even on older out-of-production weapon systems, the requirement to retrofit with more modern components involves new technology.

g. Specialized Knowledges and Skills

Because of the advanced technology involved, the task of managing a weapon system requires specialized knowledges and skills. These include basic engineering fields such as Aeronautical, Mechanical, Electrical, Electronic, and Industrial Engineering. In addition, advanced knowledges and skills in Systems Acquisition and Logistics Management are required.

5. Informal Social System

a. Informal Leadership

This includes the individual leadership abilities of the Project Manager and his staff. In a matrix organization, the success of a project is greatly dependent on informal leadership ability since administrative control over project team members is retained in the

functional groups. This is true of all three life-cycle phases. However, as the project grows older, informal leadership abilities become increasingly more important since the project usually has to compete with newer projects with higher priority. This is especially true in the Out-of-Production Phase after the project office has been disestablished and the program management has been assigned to a Weapon Systems Manager at a Field Activity.

b. Project Cohesion

Project cohesion is also of paramount importance to the success of a matrix organization for the same reasons given for leadership ability. During the Pre-Production and Production Phases, project cohesion is normally fairly good because the project office controls and directs project funds, and because of the importance and priority assigned to the project. Attempts to maintain project cohesion, however, become increasingly more difficult as the project ages and has to compete with newer programs.

Project cohesion within the Model Management office is also fairly good because of its relatively small size and close proximity of essential program element managers such as the APML and Class Desk. However, project cohesion between the Model Management office and the functional support groups at NAVAIRSYSCOMHQ and other Field Activities is somewhat deficient because of (1) scarcity of program funding, (2) low program priority, and (3) its remote location from NAVAIRSYSCOMHQ, which is a recognized source of power and authority.

c. Informal Status System

The informal status system lends prestige to the Project Manager and his staff since they are the focal point and coordinate all aspects of the project. In addition, the Project Manager is normally of the rank Captain or higher. Project charisma, although difficult to define, is also very much part of the informal status system. The above is true primarily during the Pre-Production and Production Phases while the project office is still in operation.

During the Out-of-Projection Phase, the APML, who is normally a civilian manager, assumes management of the weapon system until assigned to a Field Activity. Under the Model Management Program, the assigned Weapon Systems Manager has been of the rank Captain or lower, depending upon the size and relative importance assigned to the project. There has been a current tendency, however, to down grade the authority of the program even further by the assignment of junior Commanders or lower as the Weapon Systems Manager. In addition, program prestige and charisma are generally poor since most weapon systems assigned to Model Management are older and out-of-production.

d. Political Alliances and Coalitions

This includes the political alliances between the Project or Weapon Systems Manager, his staff, and the various members of groups with which there is interaction (Refer to figure 4-2). Political

alliances, especially with higher authority, certain Field Activities, and Fleet Commanders, are very much a part of the informal social system and can be very important to the success of the project.

During the Pre-Production and Production Phases, political alliances with selected groups in higher authority, such as OP-506 and OP-098, are usually fairly strong, and with others, it is varied. The requirement to maintain these political alliances, however, creates excessive demands on the Project Manager's time, which often directs his energies away from managing the project. During the Production Phase, political alliances with Fleet Commanders and supporting Field Activities become increasingly more important as the weapon systems become operational.

During the Out-of-Production Phase, the political alliances between the Model Management office, Type Commanders, and Field Activities are normally fairly strong but considerably weakened with higher authority due to loss of program priority on older out-of-production systems.

6. Human Dimensions

a. Experience and Educational Levels

One of the previously defined Task Attributes of Weapon Systems Management was Specialized Knowledges and Skills. The Project Manager, his staff, and most team members normally have had specialized training and/or experience in one or more of the basic

technical fields. Some members assigned to the project, although normally not many, have also had advance training and extensive experience in Systems Acquisition and Logistics Management. This is not nearly as true, however, for the Model Management staff unless experienced project management personnel from NAVAIRSYSCOMHQ are transferred to the Field Activity along with the program. The Weapon Systems Acquisition Management (WSAM) Program, as defined in BUPERSINST 1040.2, establishes formalized training and selection criteria for military project personnel. No similar type program for civilian personnel, however, has been established to date.

b. Other Human Dimensions

Other human dimensions in which there is wide variation among project management personnel include: inherent motivation, personality factors, management styles, use of power, personal needs and interest, individual beliefs and values, individual attitudes and cultural conditioning. There are certain traits, however, that tend to favor a project management environment. For example, successful Project Managers are normally highly motivated and their management styles compatible with a matrix type organization.

Recent studies on profile abilities necessary for successful Project Management include the following [Cours].

Ability to identify problems

Overall high communications skills ability

Ability to think imaginatively

Ability to think in the broadest range possible

Technical ability to analyze complex problems

High ability in interpersonal relations

Ability to interface with high ranking officers and officials

Ability to write well and present complex issues clearly

Ability to brief frequently and well

High persuasion abilities

Ability to apply regulations and standard procedures

Leadership ability

V. ORGANIZATIONAL EVALUATION

After examining the organizational definition of the three life-cycle phases of weapon systems management, as described by the application of the Systems Analysis Model in Section IV, it became apparent that there are two distinct management organizations, (1) Project Management, and (2) Model Management. The Pre-Production and Production Phases are supported by the Project Management organization, and the majority of the Out-of-Production Phase is supported by the Model Management organization. The transition period between Project Management and Model Management, during which time the program is being managed by the APML, is actually an extension of the initial Fleet logistics support aspect of Project Management and was not considered separately.

The following paragraphs in this Section consider Project Management and Model Management as two separate and distinct organizations. A review of the operational requirements of both organizations and their abilities and assets was made. In addition, a review of reported organizational problems and those elements considered essential for effective weapon systems management was also made. Finally, an evaluation was made based on information presented in this Section discussing the adequacy of Project and Model Management to accomplish

their operational requirements. Figure 3-1 presented a flowchart showing the method of evaluating the Project and Model Management organizations. Resulting conclusions concerning the adequacy of Project and Model Management to accomplish their organizational requirements are summarized in Section VI.

A. EVALUATION OF PROJECT MANAGEMENT

1. First Step: Review of Project Management Organizational Characteristics

As illustrated in figure 3-1, the first step in evaluating the organization was a review of its (a) Operational Requirements, and (b) Abilities and Assets. This information was presented in detail in Section IV, Organizational Definition, and is summarized for quick reference in table format as follows:

a. Operational Requirements

(1) Mission/Goals (Refer to Table 5-1)

(2) Responsibilities (Refer to Table 5-1)

(3) Other Requirements (Refer to Table 5-1)

b. Abilities and Assets

(1) Inputs (Refer to Table 5-2)

(2) Outputs (Refer to Table 5-3)

(3) Organizational Variables (Refer to Table 5-4)

(4) Informal Social System (Refer to Table 5-5)

(5) Human Dimensions (Refer to Table 5-6)

TABLE 5-1

REVIEW OF PROJECT MANAGEMENT OPERATIONAL REQUIREMENTS

OPERATIONAL REQUIREMENTS	DESCRIPTION
MISSION/GOALS (Ref. IV.B.4.a)	The Project Manager's primary mission is to provide to the operating forces of the Navy fully supported weapon systems which will satisfy approved operational requirements. The project scope consist of: Contract formulation Contract definition Development Test and evaluation Acquisition Initial support The Project Manager must oversee all efforts to acquire, deploy, operate, and support the weapon systems within approved schedules and budgets.
RESPONSIBILITIES (Ref. IV.B.4.a)	GENERAL RESPONSIBILITIES Define and maintain organizational relationships and responsibilities Establish firm and realistic weapon system and equipment specifications. Identify high-risk areas. Explore schedule, cost, and technical performance trade-off decisions. Select the best technical approaches. Establish firm and realistic schedules and cost estimates. Formulate realistic logistics support and operational concepts. Lay the groundwork for contracting. [Fox, P. 173]

TABLE 5-1 (cont.)

REVIEW OF PROJECT MANAGEMENT OPERATIONAL REQUIREMENTS

OPERATIONAL REQUIREMENT	DESCRIPTION
RESPONSIBILITIES (Continued) (Ref:IV.b.4.a)	SPECIFIC RESPONSIBILITIES Coordinate interface segments of project with other groups, Commands, etc. Maintain liaison with cognizant NMC staff regarding status and progress of project. Furnish to all participating organizations current information on project plans and proposed changes. Keep BUPERS informed of military personnel reqmts. Maintain continuing review of: Operational requirements, inventory objectives, schedules, and funding availability. ILS planning and implementation. Acquisition of facilities for T&E installation, operation, and maintenance, for the weapon system. Maintain liaison with cognizant personnel at T&E Activities and ensure readiness of system for OPEVAL and/or Fleet use. Head team of members from functional groups of NAVAIR and ensure their support. Direct procurement of test, SSE, technical documentation, trainers, and provide concurrence for budgetary submissions for ILS on these items. Monitor contractor test and demonstrations. Identify personnel support requirements, training, etc., for BIS, OPTEVFOR, Fleet, Training Command, NARF's, etc. Provide overall direction for procurement of maintenance and operator trainers and equipment. Provide project management services for Foreign Military Sales programs.

TABLE 5-1 (cont.)

REVIEW OF PROJECT MANAGEMENT OPERATIONAL REQUIREMENTS

OPERATIONAL REQUIREMENTS	DESCRIPTION
TIME HORIZON (Ref: IV.B.4.c)	Fixed deadlines such as carrier deployments Compressed schedules and work-arounds Urgent Fleet problems Briefings to higher echelons National defense crisis
ENVIRON-MENTAL INTERACTION (Ref:IV.B.4.d)	Upper DOD echelons: CNM, CNO, SECNAV, SECDEF, OMB Field Activities: Lab's, T&E Facilities, NARF's Congressional Committees Contractors Fleet Other System Commands
HIGHLY COMPLEX TASKS (Ref.IV.B.4.e)	Interaction with large number of Agencies and outside influences Multitude of organizational requirements and variables in bureaucratic system
HIGH TECHNOLOGY (Ref: IV.B.4.f)	Advanced and rapidly changing, especially in Electronics and Aerospace fields.
SPECIALIZED KNOWLEDGES and SKILLS (Ref:IV.B.4.g)	Basic Engineering Fields: Aeronautical, Mechanical, Electrical, Electronics, Industrial Advanced knowledges and skills in Systems Acquisition and Logisitics Management

TABLE 5-2

REVIEW OF PROJECT MANAGEMENT ABILITIES AND ASSETS

INPUTS	DESCRIPTION
RESOURCES (Ref: IV.B.1.a)	People (Typical Project) Project Manager Deputy for Fiscal Control and assistants Deputy for Planning and assistants Deputy for Air Vehicles and assistants Deputy for Weapons and assistants Deputy for Logistics Support and assistants Deputy for Foreign Military Sales and assist. Class Desk APML Contracting Officer Comptroller Functional Groups within NAVAIRSYSCOM Field Activities CNO, CNM, COMNAVAIR Contractor

TABLE 5-2 (cont.)

REVIEW OF PROJECT MANAGEMENT ABILITIES AND ASSETS

INPUTS	DESCRIPTION
RESOURCES (Ref: IV.B.1.a)	Funding Project Manager has budgetary control over RDT&E and Army (or WPN) funds. Project Managers do not have budgetary control over out-of-production funds (APN-5/OSIP, APN-6, APN-7, and O&MN). Out-of-production (logistics support) funds are managed by functional groups in NAVAIR. Facilities (Primarily Funding Dependent) Contractor's Plant Navy Laboratories T&E Facilities NARF's

TABLE 5-2 (cont.)

REVIEW OF PROJECT MANAGEMENT ABILITIES AND ASSETS

INPUTS	DESCRIPTION
STRATEGIES and PLANS (Ref: IV.B.1.b)	Primarily direction from higher authority Project Charter (mission, authority, and responsibilities) Initial support - ILS Plan DOD Component Directives and Instructions CNO strategies, Carrier Deployment Schedules, and Weapon System Planning Document (WSPD) Congressional strategies Personal Project Manager strategies
INFORMATION (Ref: IV.B.1.c)	Management Information Systems: 3M data, UR's, RISE, Contract Progress Reports, Cost/Schedule Control Systems Reports: Test, performance & field reports Meetings & conferences: Congressional committee meetings & briefings DSARC/NSARC ILS meetings Performance & Design Review meetings Etc.

TABLE 5-3

REVIEW OF PROJECT MANAGEMENT ABILITIES AND ASSETS

OUTPUTS	DESCRIPTION
PRODUCTIVITY (Various Measures) (Ref: IV.B.2.a)	Accomplishing Milestones DSARC/NSARC 0, I, II, III SAR Fleet Introduction ILS Budget Management Project Office is responsible for planning, programming, and reprogramming project funds; Budget justification, execution, and control. Out-of-production funds managed by functional groups in NAVAIR. Weapon System Design Performance BIS trials/Approval for service use Operation, Maintainability and Reliability Weapon System Readiness (Logistics Support) Initial ILS
PROJECT DEVELOPMENT (Ref: IV.B.2.b)	Actual Expenditures RDT&E New Procurement Size and Rank of Project Staff Rank of Project Manager and staff increases with size and importance of project. Normally peaks during latter part of Pre-Production Phase.

TABLE 5-4

REVIEW OF PROJECT MANAGEMENT ABILITIES AND ASSETS

ORGANIZATIONAL VARIABLES	DESCRIPTION
STRUCTURE (Ref: IV.B.3.a)	Matrix Organization - depend on functional areas to carry-out project requirements. Project Manager's position established within NAVAIRSYSCOM but he reports directly to CNO sponsor.
AUTHORITY (Ref: IV.B.3.b)	Defined in SECNAVINST 5000.1 and Project Charter. Program Manager is single central executive responsible for successful management of project toward accomplishment of its objectives. He has broad directive authority over project planning, direction, control, and resource utilization. Authority is normally well recognized. Authority Limitation: Non-control over out-of-production funds.
FORMAL MECHANISMS for PLANNING and GOAL SETTING (Ref: IV.B.3.c)	Defined in Project Charter and various DOD component directives and instructions (as revised by OMB Circular A-109). Examples: Joint Strategic Objective Plan (JSOP) Joint Force Memorandum (JFM) Program Objective Memorandum (POM) Decision Coordinating Paper (DCP) Defence (Navy) Systems Acquisition Review Council (DSARC/NSARC) Weapon Systems Planning Document (WSPD) Carrier Deployment Schedules Arm Services Procurement Regulations (ASPR) Integrated Logistics Support Plan (ILSP)

TABLE 5-4 (cont.)

REVIEW OF PROJECT MANAGEMENT ABILITIES AND ASSETS

ORGANIZATIONAL VARIABLES	DESCRIPTION
REWARD and INCENTIVE CRITERIA (Ref: IV.B.3.d)	Fitness reports for Project Manager are signed by COMNAVAIRSYSCOM. Project staff fitness reports are signed by the Project Manager. Performance evaluations for civilian employees. Plans underway to allow Project Manager to participate in fitness reports and performance evaluations of personnel in functional support groups assigned to project. Informal appraisal from higher authority and Fleet Commanders regarding project performance: Successful accomplishment of DSARC/NSARC milestones. Ability to promote and defend project. Budgetary control over project cost. Overall systems readiness for operational sys.
PHYSICAL LOCATION (Ref: IV.B.3.e)	Project office is located at NAVAIRSYSCOMHQ, Wash. DC. Location is enhanced by proximity to Pentagon and many interacting agencies.
PERSONNEL POLICIES (Ref: IV.B.3.f)	BUPERSINST 1040.2 (WSAM Program) established formal training and selection criteria for military Systems Acquisition personnel. DOD Directive 5000.1 addresses assignment and tenure of Project Managers. No similar programs for civilian Systems Acquisition Management personnel have been established to date.

TABLE 5-5

REVIEW OF PROJECT MANAGEMENT ABILITIES AND ASSETS

INFORMAL SOCIAL SYSTEM	DESCRIPTION
INFORMAL LEADERSHIP ABILITY (Ref: IV. B. 5. a)	Informal leadership ability (should be) considered in selection of project management personnel since it is an important requirement to management of a weapon system in a matrix organization.
PROJECT COHESION (Ref: IV. B. 5. b.)	Normally good during Pre-Production Phase and early part of Production Phase due to project priority and control of RDT&E and new procurement funds. More difficult to maintain toward latter part of Production Phase as project becomes older and must compete with newer projects. Also, Project Manager has no budgetary control over out-of-production funds.
INFORMAL STATUS SYSTEM (Ref: IV. B. 5. c)	Prestige and charisma normally good on new projects since Program Manager and staff are focal points and coordinate all aspects of project. Project Manager is normally a Captain or higher.
POLITICAL ALLIANCES and COALITIONS (Ref: IV. B. 5. d)	Strong alliance between Project Manager and higher authority during Pre-Production and Production Phases. Alliance with Fleet Commanders becomes more important during Production Phase. Excessive demands on time to maintain political alliances.

TABLE 5-6

REVIEW OF PROJECT MANAGEMENT ABILITIES AND ASSETS

HUMAN DIMENSIONS	DESCRIPTION
EXPERIENCE and EDUCATION (Ref: IV.B.6.a)	Specialized training and experience in basic technical fields is normally required for Project Manager, staff, and team members. Advance training and experience in Systems Acquisition and Logistics Management is infrequent. WSAM Program establishes career development standards for military personnel in Systems Acquisition Management. No career development program for civilians in Systems Acquisition Management has been established to date.
OTHER HUMAN DIMENSIONS (Normally considered when selecting project personnel) (Ref: IV.B.6.b)	Management styles and abilities Motivation Inherent abilities Etc.

2. Second Step: Review of Reported Project Management Problems

As illustrated in figure 3-1, the second step in evaluating the organization was a review of reported problems.

Appendix B contains a list of management problems reported from interviewing numerous Project and Model Management personnel. Many of the problem statements are the result of inputs from several individuals and most are the result of more than one input. Problems pertinent to Project Management are grouped and listed below for reference.

a. Problems Affecting Overall Project Effectiveness

(1) Micro-Management from higher authority.

(2) Excessive demands on Project Manager and staff's time for briefs and pre-briefs to higher authority.

(3) Extensive paperwork, documentation, DCP's, test plans, and details for higher authority

(4) Lack of adequate project support and funding from higher authority.

(5) Conflicting and frequently changing requirements from higher authority

(6) Budget changes by Congress, NAVCOMP, and OMB have severe impact on project and increase out-year costs.

(7) Budget cycle is inflexible. Budget cycles and project cycles are out-of-synch.

(8) General requirement to not be completely honest in order to get things done and keep project moving.

(9) Continually diminishing engineering and logistics talent. Due to lack of sufficient personnel, never able to spend enough time on any given project to do an adequate job.

(10) Lack of qualified personnel in engineering and logistics functional areas.

(11) Slow command response to personnel requirements.

b. Problems related to Integrated Logistics Support

(1) Project funds on many projects are directed to Participating Managers in the functional groups bypassing the APML who has the lead ILS responsibility.

(2) Lack of flexibility with funding due to different appropriation categories (APN-1, APN-5, APN-6, APN-7, O&MN, etc.)

(3) Project Manager has no control over O&MN funds allocated to support his project.

c. General Management Problems

(1) Lack of proper communications and coordination between project office and project team members in functional areas. Also, between other project managers on common equipments.

(2) Uncertainty of organizational elements in support of project.

(3) Need better definition of project responsibilities, authority, and interrelationship.

(4) More authority and responsibility is needed over individuals assigned to functional groups.

(5) Difficult to generate team spirit in matrix organization.

(6) Individual and parochial interest and general lack of overall motivation interferes with project interest.

(7) Lack of career development and promotional opportunities for civilian staff within the project office.

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3. Third Step: Review of Essential Elements to Effective Project Management

As illustrated in figure 3-1, the third step in evaluating the organization was a review of elements considered essential to effective Project Management.

Appendix C contains the results of an evaluation to determine those elements considered essential to effective program management. A proposed list of elements was presented to experienced Project and Model Management personnel during an interview. They were asked to revise the list as required, and then rank them in order of significance. Project Management involves the management of a weapon system during the Pre-Production and Production Phases of its life cycle. The weighted average results from those projects managing the Pre-Production or Production Phases of a weapon system is listed below in ranked order of significance starting with the most essential element.

RANK	ESSENTIAL ELEMENTS TO EFFECTIVE PROJECT MANAGEMENT
1	Availability of funding to project
2	Control of project funding
3	Good project management talent
4	Clearly defined and recognized authority
5	Availability of good engineering and logistics talent
6	Project priority
7	Good working relationship with CNO and Fleet Commanders

8 Good working relationship with contractor

9 Good management information systems

10 Availability of travel funds

4. Fourth Step: Determination of Project Management Organizational Adequacy

As illustrated in figure 3-1, the fourth and last step in evaluating the organization was a determination of the adequacy of Project Management to accomplish its operational requirements.

A thorough review of the abilities and assets of Project Management in Tables 5-2 through 5-6 indicates that there are many good features about the organization as well as deficiencies. However, there are many influences in the Project Management environment, both internal and external that significantly impact its effectiveness. Further review of the reported organizational problems and those elements considered essential for effective Project Management presented earlier in Sections V.A.2 and V.A.3 provide key insight and tend to substantiate the results of the following evaluation. Appropriate reference paragraphs and tables are shown in parenthesis.

a. Good Features of Project Management

Within NAVAIRSYSCOM, Project Management provides a centralized and dedicated management organization for integrating the diverse functional activities of RDT&E, procurement, and initial deployments of a complex weapon system.

Project Management within the Navy uses a matrix organization (Table 5-4, Structure). This is in contrast to the organizational structures of Project Management in the Air Force, which uses a self-contained project office, and the Army, which uses a combination of the two. Where there are a large number of projects involved, which is the case within the Navy, the total number of people required to support a matrix organization is significantly lower than that of the self-contained project. For example, Fox reports that while the Navy had 14 people staffed in the F-14 project office and another 92 people assigned to the F-14 project from the functional areas within NAVAIRSYSCOM, the Air Force had 243 people assigned to the self-contained F-15 project office [Fox, p. 171]. Furthermore, it has been observed and reported that in organizations that use self-contained project offices, the best technical and managerial talent, and other resources tend to become quickly concentrated in the projects with the highest priority, leaving the other projects deficient. This is obviously a disadvantage where there are multiple projects to be supported. Therefore, the matrix organizational structure utilized by NAVAIRSYSCOM Project Management provides an efficient use of scarce personnel resources where there are a large number of complex projects to support.

Another important aspect to consider is the organization's capability to maintain project control over its key operational requirements. A review of the abilities and assets of Project Management in

Tables 5-2 through 5-6 indicates that overall project control in most areas other than logistics support is adequate. The degree of project control is directly related to those areas over which there is control of funds. There obviously are many other factors that also affect project control both directly and indirectly, but in a highly competitive environment where project funds are scarce, budgetary control is imperative to effective project control. This attitude is shared by almost all Project Managers who ranked control of project funds second only to availability of funds among those elements considered essential to effective project management (V.A.3).

Further review of the abilities and assets of Project Management indicate that there are many more good features of lesser significance when considered individually, but are very important to the management organization as a whole. However, these tend to be overshadowed by the deficiencies in the system.

b. Deficiencies of Project Management

One of the major problems that impacts the overall capability of most projects to accomplish their mission is the inability of Project Managers and their staff to perform their most basic function - to manage! First of all, project personnel readily admit that most major decisions that affect the progress of the project are made at higher levels (Table 5-2, Input Strategies and Plans). Secondly, excessive demands are normally made on their time in preparing briefings

and special studies for higher authority (Table 5-8, Political Alliances). This situation is reflected in reported comments of "micro-management" from higher authority, the requirement for briefs and pre-briefs, and the extensive paperwork and details for higher authority (V.A.2.a). Third, there is an informal requirement to respond to a multitude of requests for information from agencies outside of the chain-of-command. Therefore, overall project effectiveness in accomplishing its mission/goals is reduced due to erosion of the Project Manager's basic function to manage the project.

Another problem that reduces overall project effectiveness is the requirement to continually justify, defend, and sell the project. In a highly competitive environment, the Project Manager must continually fight for a larger budget and larger program in order for his project to survive (Table 5-1, Responsibilities, and Table 5-3, Productivity). He must sell the program to higher levels of DOD and Congress regardless of whether he sees the need. In order to do this, he must actually be somewhat deceptive. This is reflected in reported comments that there is a general requirement not to be completely honest in order to get things done and keep the project moving (V.A.2.a). Also, the Project Manager must protect his budget and prevent funds from being pulled back once he gets them by committing project funds as early as possible in the fiscal year, regardless of whether the timing is right. Therefore, overall project effectiveness in accomplishing its

mission/goals is reduced due to the requirement to continually promote and defend the project before higher levels of DOD and Congress.

One of the more prevalent problem areas reported that impacts overall project effectiveness relates to the nature of support and direction received from higher authority. As stated earlier, most major decisions that affect the progress of the project are made at higher levels. Because of the highly political environment of Congress with the influence of political lobbies, etc., and its interaction with the upper levels of the Executive Branch and DOD, there is often an apparent lack of full support and needed funding on many projects. Furthermore, the requirements passed down from higher authority are often conflicting and frequently changing (V.A.2.a). For example, Congress may reduce the planned funding level and number of aircraft to be procured during a given year while the OPNAV requirement to satisfy critical milestones related to aircraft carrier deployments remains unchanged. One of the reported comments reflects this problem by indicating that budget changes by Congress, NAVCOMP, and OMB have a severe impact on the project and increase planned out-year costs (V.A.2.a). These conditions obviously make it very difficult for the Project Manager and his staff to plan and effectively manage the project. Therefore, overall project effectiveness in accomplishing its mission/goals is reduced due to: lack of adequate project support from higher authority; and conflicting and frequently changing requirements from higher authority.

Because of the recent trend over the past several years to decentralize, many functions in the various engineering and logistics support groups within NAVAIRSYSCOM have been reorganized, consolidated, and/or reassigned to Field Activities. This is obviously a problem for the project manager and his staff in a matrix organization who must depend on these groups for timely functional support. For example, it is not unusual for a Project Manager to be requested to provide a brief at the Pentagon requiring a technical analysis by the end of the work day to defend his project (Table 5-1, Time Horizon and Environmental Interaction). Since the previously qualified technical personnel that he used to depend on for this information are now, in a lot of instances, non-existent or located at a Field Activity, he is at a great disadvantage. The availability of good engineering and logistics talent was ranked fifth among those elements considered most essential to effective project management (V.A.3). One frequent comment from Project Managers is that due to the lack of sufficient personnel, they are never able to spend enough time on any given project to do an adequate job (V.A.2.a). For this reason, much of the workload formerly handled within the functional areas at NAVAIRSYSCOMHQ is contracted-out, which is normally very costly. Furthermore, this usually makes the Project Manager more dependent upon the contractor to help promote and defend his project. This is often in direct conflict with good business practice to maintain an arms length and objective

relationship with the contractor. Therefore, overall project effectiveness in accomplishing its mission/goals is reduced due to continually diminishing engineering and logistics talent in the functional areas at NAVAIRSYSCOMHQ.

As discussed in Section IV, one of the Task Attributes of weapon systems management was Specialized Knowledges and Skills. Also, among those elements considered essential to effective project management, good project management talent ranked third (V.A.3). In order to be an effective and efficient manager, advanced training and experience in Systems Acquisition and Logistics Management is essential (Table 5-1, Specialized Knowledges and Skills). However, there is a problem in obtaining and keeping such qualified personnel. DOD has attempted to address this problem for military personnel through the Weapon Systems Acquisition Management (WSAM) program by establishing standards for career development and advancement of systems acquisition management personnel. Although there has been recent concern within DOD about the lack of a similar career development program for civilians, there is no established program to date (Table 5-4, Personnel Policies). Most civilian jobs within the project office are viewed by many as dead-ended with little chance of promotion. This is understandable since most of the senior positions within the project office are normally staffed by military personnel. Therefore,

overall project effectiveness is reduced due to the problem of obtaining and keeping highly qualified civilian personnel. This is due to the lack of career development and promotional opportunities within the project office.

There are many general problems characteristic of a matrix organization that reduce overall project effectiveness. Some of the reported problems indicated a lack of proper communication and coordination between the project office and team members in the functional areas. There was concern expressed over the uncertainty of various organizational elements to support the project. The need for better definition of project responsibilities, authority, and interrelationships, and control over individuals assigned to functional groups was also expressed (V.A.2.c). Clearly defined and recognized authority was ranked number four among those elements considered essential to effective project management (V.A.3). Some Project Managers experienced difficulties in generating team spirit and motivation. Although these problems are typical of a matrix organization, they can be minimized with special attention given to proper management skills and informal leadership approaches (Table 5-5, Informal Leadership Ability).

One of the good features stated earlier about project management is that overall project control is adequate in most areas except logistics support. It was further explained that the degree of project control is directly related to those areas over which there is control

of funds. Since control over O&MN funds is normally maintained by the functional support groups within NAVAIRSYSCOM, the Project Manager does not control related logistics support areas such as rework, contractor maintenance engineering services (CMES), Cognizant Field Activity (CFA) support, etc. (Table 5-2, Input Resources - funding). Although the Project Manager does provide inputs to the cognizant budget manager, his project requirements are considered along with other projects. Since the Project Manager is not setting the priorities on the expenditure of O&MN funds, he does not have control. Therefore, management ability over logistics support is degraded due to lack of Project Manager control over O&MN funds.

Section II defines the Assistant Project Manager, Logistics (APML), as having lead management responsibility within the functional groups at NAVAIRSYSCOM for integrated logistics support (Table 5-2, Input Resources - People). In this capacity, he heads-up a team of Participating Managers to provide logistics support to operational systems in the Fleet. It is common practice on many projects, however, to direct project funds to the Participating Managers on the team completely bypassing the APML and his control (V.A.2.b). In such cases, management ability over logisitics support is degraded due to the practice of directing project funds to Participating Managers instead of to the APML who has lead ILS responsibility.

The Project Manager's ability to exercise good business judgement is quite often degraded because of the restrictions placed on how and when different appropriation categories can be utilized (V.A.2.b). Although this could apply to all phases of the project, it seems to have its greatest impact on logistics support where out-of-production support funds such as APN-5, APN-6, APN-7 (or WPN) and O&MN are scarce and RDT&E and new procurement APN-1 (or WPN) funds are available (Table 5-2, Input Resources - Funding). For example, in the interest of creating competition, the Project Manager might need the flexibility of having work performed by a contractor (which normally requires APN funds) or in-house Navy (which normally requires O&MN funds). Because the project was originally planned and budgeted around accomplishing the work in-house using O&MN funds, he may be forced to stick with his original plans instead of using a commercial contractor, even though the contractor is cheaper. Comptrollers within the Government are required by law (Section 3678 of Revised Statues - 31 USC 665 - Anti-Deficiency Act) to ensure that funds are used only for what they were appropriated. The system could be changed, however, by congressional action. Therefore, management ability over logistics support is degraded due to lack of flexibility in utilizing different appropriation categories.

Section II defines the Class Desk as having the lead engineering responsibility for basic weapon system design and performance.

Like the APML, the Class Desk engineer normally heads-up his team of engineers in the functional groups (Table 5-2, Input Resources - People). It is also common practice on many projects to direct funds to the Participating Managers on his team completely bypassing the Class Desk and his control. This is not quite as serious of a management problem, however, as with the APML since the Class Desk directs many of his work efforts by AIRTASK which identifies the project order committing the funds. Although this system alleviates the Class Desk from the burden of issuing Project Orders, it still prevents him from exercising full managerial control. Therefore, management ability over responsibilities related to basic design and performance is degraded when project funds are directed to Participating Managers instead of to the Class Desk who has lead engineering responsibility.

B. EVALUATION OF MODEL MANAGEMENT

1. First Step: Review of Model Management Organizational Characteristics

As illustrated in figure 3-1, the first step in evaluating the organization was a review of its (a) Operational Requirements, and (b) Abilities and Assets. This information was presented in detail in Section IV, Organizational Definition, and is summarized for quick reference in table format as follows:

a. Operational Requirements

(1) Mission/Goals (Refer to Table 5-7)

(2) Responsibilities (Refer to Table 5-7)

TABLE 5-7

REVIEW OF MODEL MANAGEMENT OPERATIONAL REQUIREMENTS

OPERATIONAL REQUIREMENTS	DESCRIPTION
MISSION/GOALS (Ref: IV. B. 4. a)	The WSM is the principal advisor, consultant, and manager of the weapon system for COMNAVAIR. He is responsible for overall management of the weapon system.
RESPONSIBILITIES (Ref: IV. B. 4. a.)	Planning and executing total systems integration Design and maintenance engineering Modifications and improvements Maintenance and rework Testing and evaluation Configuration Control Material acquisition Contracting Interservice program coordination Fleet Logistics support spare and repair parts rework programs training facilities PGSE contractor or Navy technical services technical documentation Foreign military sales logistics support

TABLE 5-7 (cont.)

REVIEW OF MODEL MANAGEMENT OPERATIONAL REQUIREMENTS

OPERATIONAL REQUIREMENTS	DESCRIPTION
TIME HORIZON (Ref: IV. B. 4. c)	Fixed deadlines such as carrier deployments Compressed schedules and work-arounds Urgent Fleet problems Briefings to higher echelons National defense crisis
ENVIRON-MENTAL INTERACTION (Ref: IV. B. 4. d)	Upper DOD echelons: CNM, CNO, SECNAV, SECDEF, OMB Field Activities: Lab's, T&E Facilities, NARF's Congressional Committees Contractors Fleet Other System Commands
HIGHLY COMPLEX TASKS (Ref: IV. B. 4. e)	Interaction with large number of Agencies and outside influences Multitude of organizational requirements and variables in bureaucratic system
HIGH TECHNOLOGY (Ref: IV. B. 4. f)	Advanced and rapidly changing, especially in Electronics and Aerospace fields.
SPECIALIZED KNOWLEDGES and SKILLS (Ref: IV. B. 4. g)	Basic Engineering Fields: Aeronautical, Mechanical, Electrical, Electronics, Industrial Advanced knowledges and skills in Systems Acquisition and Logistics Management

TABLE 5-8

REVIEW OF MODEL MANAGEMENT ABILITIES AND ASSETS

INPUTS	DESCRIPTION
RESOURCES (Ref: IV.B.1.a)	People (Typical Program) Weapon Systems Manager Deputy Manager Class Desk or equivalent APML or equivalent Contracting Officer (at NAVAIRSYSCOMHQ) Comptroller (at NAVAIRSYSCOMHQ) Specialized Engineering & Logistics Managers *Functional Groups* within NAVAIRSYSCOM Field Activities CNO, CNM, COMNAVAIR Contractor Funding No control over any funds Scarcity of available funds (OSIP/O&MN) Facilities (Primarily Funding Dependent) Contractor's Plant Navy Laboratories T&E Facilities NARF's

TABLE 5-8 (cont.)

REVIEW OF MODEL MANAGEMENT ABILITIES AND ASSETS

INPUTS	DESCRIPTION
STRATEGIES and PLANS (Ref: IV.B.1.b)	Primarily direction from higher authority Model Management Instruction, NAVAIRINST 5400.70, promulgates formal policy that reserves authority for planning, programming, and budgeting and depot workload control to functional managers within NAVAIR. Integrated logistics support plan DOD Component Directives & Instructions CNO Strategies, Carrier Deployment Schedules and Weapon Systems Planning Document (WSPD) Congressional Strategies Personal WSM Strategies
INFORMATION (Ref: IV.B.1.c)	Management Information Systems: 3M data, UR's, RISE Reports: Test, performance & field reports Meetings & conferences: ILS, program reviews, etc.

TABLE 5-9

REVIEW OF MODEL MANAGEMENT ABILITIES AND ASSETS

OUTPUTS	DESCRIPTION
PRODUCTIVITY (Various Measures) (Ref: IV.B.2.a)	Accomplishing Milestones Integrated Logistics Support (ILS) Retrofit programs Service Life Extension Programs (SLEP) Budget Management Out-of-production funds managed by functional groups in NAVAIR. Weapon System Design Performance Operation, Maintainability, and Reliability Weapon System Readiness (Logistics Support) Integrated Logistics Support Dependent upon: responsiveness to Fleet problems, material support, technical manual support, support equipment, aircraft and component rework, maintenance engineering support, and shipboard interface support.
PROJECT DEVELOPMENT (Ref: IV.B.2.b)	Actual Expenditures Operational Safety Improvement Program (OSIP) funds. Service Life Extension Program (SLEP) using Conversion in Lieu of Procurement (CILOP) funds. Size and Rank of Project Staff Varies with size and importance of program, and also upon Weapon Systems Manager's ability and success in justifying personnel requirements to Command.

TABLE 5-10

REVIEW OF MODEL MANAGEMENT ABILITIES AND ASSETS

ORGANIZATIONAL VARIABLES	DESCRIPTION
STRUCTURE (Ref: IV.B.3.a)	Matrix organization. Depend on functional areas to carry-out program requirements. WSM and staff are administratively assigned to Field Activity Command. WSM and staff are functionally assigned to COMNAVAIRSYSCOM via AIR-04. WSM reports directly to CNO sponsor on program matters.
AUTHORITY (Ref: IV.B.3.b)	Defined in NAVAIRINST 5400.70. WSM is primary executive responsible for overall management of a weapon system. Authority is not fully recognized by all groups. Authority scope primarily limited to logistics management & support of operational systems in Fleet. Authority Limitation: Non-Control over funds budgeted for project. WSM does not have AIRTASK sign-off authority.
FORMAL MECHANISMS for PLANNING and GOAL SETTING (Ref: IV.B.3.c)	Defined in DOD component directives and instructions POM WSPD Carrier Deployment Schedules Integrated Logistics Support Plan ASPR

TABLE 5-10 (cont.)

REVIEW OF MODEL MANAGEMENT ABILITIES AND ASSETS

ORGANIZATIONAL VARIABLES	DESCRIPTION
REWARD and INCENTIVE CRITERIA (Ref: IV.B.3.d)	Fitness reports for WSM are signed by Field Activity Commanding Officer. Loss in program management objectivity occurs when Field Activity and program priorities conflict. Civilian employees receive performance evaluations. WSM does not participate in fitness reports and performance evaluations of personnel in functional support groups. Informal appraisal from Fleet Commanders regarding WSM performance: Meeting critical project milestones. Minimizing design and logistics problems. Overall systems readiness. Performance and reliability improvement changes
PHYSICAL LOCATION (Ref: IV.B.3.e)	Model Management office located at Field Activity such as NARF. DOP and CFA is normally located at same Activity. Many functional support groups located at NAVAIRSYSCOMHQ and other Field Activities. Program management is enhanced by centrally locating WSM, CFA, and DOP at same Activity since majority of problems logistic in nature.
PERSONNEL POLICIES (Ref: IV.B.3.f)	No formalized programs or DOD directives addressing personnel policy for Model Management such as WSAM Program (BUPERSINST 1040.2) and DOD Directive 5000.1.

TABLE 5-11

REVIEW OF MODEL MANAGEMENT ABILITIES AND ASSETS

INFORMAL SOCIAL SYSTEM	DESCRIPTION
INFORMAL LEADERSHIP ABILITY (Ref: IV.B.5.a)	Informal leadership ability (should be) considered in selection of model management personnel since important requirement to management of out-of-production system in matrix organization.
PROJECT COHESION (Ref: IV.B.5.b)	Good within Model Management Office. Poor with respect to NAVAIRSYSCOM functional support groups and field activities.
INFORMAL STATUS SYSTEM (Ref: IV.B.5.c)	Program prestige and charisma poor due to older out-of-production systems. Increasing tendency to down-grade program authority by assignment of Junior Commanders or lower as WSM.
POLITICAL ALLIANCES and COALITIONS (Ref: IV.B.5.d)	Strong alliance between WSM & Type Commanders. Weak alliance between WSM & Field Activities. Weak alliance between WSM & Higher Authority.

TABLE 5-12

REVIEW OF MODEL MANAGEMENT ABILITIES AND ASSETS

HUMAN DIMENSIONS	DESCRIPTION
EXPERIENCE and EDUCATION (Ref: IV.B.6.a)	Specialized training and experience in basic technical fields is normally required for WSM, staff, and team members. Advance training and experience in Systems Acquisition and Logistics Management is infrequent. WSAM program establishes career development standards for military personnel in Systems Acquisition Management. There is no similar program for civilians established to date.
OTHER HUMAN DIMENSIONS (Normally considered when selecting Model Management personnel) (Ref: IV.B.6.b)	Management styles and abilities Motivation Inherent abilities

(3) Other Requirements (Refer to Table 5-7)

b. Abilities and Assets

(1) Inputs (Refer to Table 5-8)

(2) Outputs (Refer to Table 5-9)

(3) Organizational Variables (Refer to Table 5-10)

(4) Informal Social System (Refer to Table 5-11)

(5) Human Dimensions (Refer to Table 5-12)

2. Second Step: Review of Reported Model Management Problems

As illustrated in figure 3-1, the second step in evaluating the organization was a review of reported problems.

Appendix B contains a list of management problems reported from interviewing numerous Project and Model Management personnel. Many of the problem statements are the result of inputs from several individuals and most are the result of more than one input. Problems pertinent to Model Management are grouped and listed below for reference.

a. Problems Related to Program Control

(1) Need for better definition of Weapon Systems Manager's responsibility, authority, and interrelationships.

(2) Weapon Systems Manager's responsibilities are not fully supported by NAVAIRSYSCOM - responsibilities exceed authority.

(3) Program decisions made by functional groups are not coordinated with the Weapon Systems Manager.

(4) Lack of functional and Field Activity support for old aircraft.

(5) Non-control of available funds by Weapon Systems Manager.

b. Problems Related to Integrated Logistics Support (ILS)

(1) Lack of adequate funds to Weapon Systems Manager for engineering and logistics support of older aircraft.

(2) Non-control of available funds by Weapon Systems Manager.

3. Third Step: Review of Essential Elements to Effective Model Management

As illustrated in figure 3-1, the third step in evaluating the organization was a review of elements considered essential to effective Model Management.

Appendix C contains the results of an evaluation to determine those elements considered essential to effective program management. A proposed list of elements was presented to experienced Project and Model Management personnel during an interview. They were asked to revise the list as required, and then rank them in order of significance. Some project offices manage both in-production and out-of-production weapon systems, and their inputs have also been included along with those for Model Management since the requirements essential for effective management of out-of-production systems are considered the same as for Model Management. The weighted average results from those programs supporting out-of-production weapon systems is listed below in ranked order of significance starting with the most essential element.

RANK	ESSENTIAL ELEMENTS TO EFFECTIVE MODEL MANAGEMENT
1	Clearly defined and recognized authority
2	Availability of funding to program
3	Control of program funding
4	Availability of good engineering and logistics talent
5	Good program management talent
6	Program priority
7	Good working relationship with CNO and Fleet Commanders
8	Good management information system
9	Good working relationship with contractor
10	Availability of travel funds

4. Fourth Step: Determination of Model Management Organizational Adequacy

As illustrated in figure 3-1, the fourth and last step in evaluating the organization was a determination of the adequacy of Model Management to accomplish its operational requirements.

A thorough review of the abilities and assets of the Model Management Program presented in Tables 5-8 through 5-12 indicates that there are both good features as well as deficiencies in the organization. Further review of the reported organizational problems and those elements considered essential for effective Model Management presented earlier in Sections V. B. 2 and V. B. 3 tend to substantiate the

results of the following evaluation. Appropriate reference paragraphs and tables are shown in parenthesis.

a. Good Features of Model Management

One of the strong points of Model Management is its internal project cohesion among staff members within the Model Management office (Table 5-11, Project Cohesion). Because of its relatively small size and close proximity of essential managers, such as the APML and Class Desk, a centralized and dedicated effort is provided toward the support of an out-of-production weapon system. Also, because of the Model Management's physical location at or near the same Facility as the Designated Overhaul Point (DOP) and Cognizant Field Activity (CFA), a more coordinated effort to provide timely solutions to Fleet problems is possible (Table 5-10, Physical Location). Therefore, response to Fleet reported problems is facilitated due to colocation of Model Management Office and key logistic support groups (CFA and DOP). Logistic support to the Fleet is also enhanced by the relatively strong political alliances that tend to develop between the Weapon Systems Manager, his staff, and Type Commanders (Table 5-11, Political Alliances). Further review of the abilities and assets in Tables 5-8 through 5-12 indicate that there are many more good features of lesser significance when considered individually, but are very important to the management organization as a whole. However, these tend to be overshadowed by the deficiencies in the program.

b. Deficiencies of Model Management

One of the most serious deficiencies in the Model Management Organization that tends to impact all areas of responsibility is the lack of control over any program funds (Table 5-8, Input Resources - Funding). This deficiency was also one of the reported problems (V.B.2.a) and was ranked third from the most significant elements considered essential to effective program management (V.B.3). Current NAVAIR policy reserves authority for planning, programming, and budgeting and depot workload control to the functional managers within NAVAIRSYSCOMHQ (Table 5-8, Input Strategies and Plans). Program funds for support of out-of-production aircraft are therefore budgeted and managed within the functional support groups. This includes APN-5, APN-6, APN-7 (or WPN) and O&MN appropriations. Since these funds are budgeted for the support of all out-of-production systems, those programs given the highest priority normally get the majority of funds. It should be emphasized that whoever controls the budget is almost always in the best position to interpret and establish priorities on how the funds are expended. Therefore, overall program control by the Weapon Systems Manager is inadequate due to lack of control over any funds. Furthermore, management ability over an integrated logistics support program is significantly degraded due to lack of funding control.

Although the Weapon Systems Manager is required to provide budgetary inputs to NAVAIR regarding his program requirements

for the next year, funds for out-of-production systems are scarce and, more often than not, are not approved by CNO. Since the Weapon Systems Manager does not have his own operating budget around which he can plan, program, and manage (and also justify and defend when required), he can not depend on funds being available when needed to support his operational requirements. The lack of adequate funds for engineering and logistics support of older aircraft was one of the reported problems (V.B.2.b). Also, the availability of funding to the program ranked second among those elements considered essential to effective Model Management (V.B.3). Fleet Logistics support is therefore severely restricted due to lack of available funds when needed.

Another serious deficiency that impacts overall program control is in the area of recognized program authority and responsibilities. There is a general tendency within NAVAIR, various Field Activities, and CNO, to not recognize the authority and assigned responsibilities of the Weapon Systems Manager regarding the total program (Table 5-10, Authority, and Table 5-7, Responsibilities). This further generates the tendency for the functional support groups to not coordinate their decisions with the Weapon Systems Manager, even though their decisions may have an overall impact on the program. The need for better definition of Weapon Systems Manager's responsibility, authority, and interrelationships was one of the reported problems (V.B.2.a). Another was that the Weapon Systems Manager's responsibilities are not fully

supported by NAVAIRSYSCOM. Clearly defined and recognized authority was ranked as the most significant element essential to effective Model Management (V.B.3). Although authority recognition is a characteristic problem with matrix organizations, the situation is aggrevated in the Model Management program with the decentralized location away from the functional managers at NAVAIRSYSCOMHQ and by the lack of funding control (Table 5-10, Physical Location and Table 5-8, Input Funding). Therefore, overall program control by the Weapon Systems Manager is inadequate due to: lack of recognition of WSM authority and responsibility by all NAVAIR groups, Field Activities, and CNO; and a tendency of functional support groups at NAVAIR and Field Activities not to coordinate decisions having overall program impact with the WSM.

AIRTASK signoff authority has not been assigned to the Weapon Systems Manager and is another situation resulting from responsibilities not being recognized by NAVAIR (Table 5-10, Authority). Although the Weapon Systems Manager is responsible for the planning and execution of efforts at various Field Activities in support of his program (such as test and evaluation programs), he does not have the authority to sign-off the AIRTASK that he must prepare to direct the efforts (Table 5-7, Responsibilities). This means that the responsible code of the AIRTASK is someone other than the Weapon Systems Manager who actually has the overall responsibility. Therefore, overall program control by the Weapon Systems Manager is also inadequate due to lack of AIRTASK sign-off authority.

Another area that is becoming increasingly more deficient and affects overall program control is the Informal Status System. In spite of the fact that program prestige and charisma are already poor on older out-of-production systems, several Model Management programs have experienced further degradation in informal program authority by assignment of junior level officers or officers with colateral duties to the Weapon Systems Manager position (Table 5-11, Informal Status System). One of the reported problems was a lack of functional and Field Activity support for old aircraft (V.B.2.a). Clearly defined and recognized authority was ranked first and program priority was ranked sixth among those elements considered essential to effective Model Management (V.B.3). Therefore, overall program control by the Weapon Systems Manager is inadequate due to degradation of informal program authority by junior officers and/or colateral assignments to the WSM position.

A related problem to the preceding one that tends to further degrade program authority is the Command level responsible for providing the Weapon Systems Manager's fitness report. Initially, with the advent of the Model Management program, the need was recognized for a concurrent fitness report from the Field Activity Commanding Officer, to which the Weapon Systems Manager was administratively assigned, and from NAVAIRSYSCOM (AIR-04), to which he was functionally responsible. Recently, however, the practice of providing a concurrent

fitness report for most Weapon Systems Managers from AIR-04 has been terminated. With only a single fitness report from the Field Activity Commanding Officer, program management objectivity ceases when there is a conflict between program priorities and those established by the Field Activity to which the Weapon Systems Manager is assigned (Table 5-10, Reward and Incentive Criteria). Therefore, overall program control is inadequate due to degradation of program management objectivity when the Weapon Systems Manager's fitness reports are provided solely by the assigned Field Activity Commanding Officer.

Another deficiency of the Model Management Organization relates to Reward and Incentive Criteria. One of the problems typical of matrix organizations is that the fitness reports and performance evaluations for Participating Managers in the functional support groups are normally appraised within the functional groups instead of by the Weapon Systems Manager whom they support (Table 5-10, Reward and Incentive Criteria). Again, as indicated previously, one of the reported problems was a lack of functional and Field Activity support for old aircraft. Overall program control by the Weapon Systems Manager is therefore inadequate due to non-participation of the WSM in fitness report and performance evaluations of personnel in functional support areas.

VI. SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

A. SUMMARY

Section I stated that the primary objective of this study was to improve the effectiveness of Weapon Systems Management within the Naval Air Systems Command. The planned method of achieving this objective was to systematically perform an organizational analysis of all phases of the management system with the intent of identifying deficiencies and possibly influencing some forms of corrective action.

In addition to researching the basic literature on organization and systems theory, and reviewing pertinent Defense Department directives and instructions, a significant number of experienced managers from many of the Project and Model Management Offices were interviewed to establish an information base. A Systems Analysis Model was developed to define the management organization and present the collected information in an organized format in Section IV.

An evaluation of the two distinct management organizations, Project Management and Model Management, was made in Section V by reviewing their operational requirements (mission/goals, responsibilities, etc.) in light of available abilities and assets. Additional information collected during the interviews was also presented in Section V to further substantiate conclusions drawn from an evaluation regarding the adequacy of the Project and Model Management Organizations to accomplish their

operational requirements. A summary of these conclusions is presented in the following paragraphs.

B. CONCLUSIONS

The results of the evaluation in Section V indicated that while there are good features to the Weapon Systems Management Organization, there are also many deficiencies that reduce overall effectiveness. The resulting conclusions are listed in the following paragraphs for both Project Management and Model Management.

1. Project Management

(a) Good Features (Refer to Section V.A.4.a)

(1) A centralized and dedicated management organization is provided for integrating the diverse functional activities of RDT&E, procurement, and initial deployments of a complex weapon system.

(2) The matrix organizational structure utilized by NAVAIRSYSCOM Project Management provides an efficient use of scarce personnel resources where there are a large number of complex projects to support.

(3) Overall project control in most areas other than logistics support is adequate.

(b) Deficiencies (Refer to Section V.A.4.b)

(1) Overall project effectiveness in accomplishing mission/goals is reduced due to:

Erosion of Project Manager's basic function to manage the project.

Requirement to continually promote and defend the project before higher levels of DOD and Congress.

Lack of adequate project support from higher authority.

Conflicting and frequently changing requirements from higher authority.

Continually diminishing engineering and logistics talent within functional areas at NAVAIRSYSCOM.

Problem of obtaining and keeping highly qualified civilian personnel due to lack of career development and promotional opportunities within the project office.

General problems characteristic of a matrix organization.

(2) Management ability over logistics support is degraded due to:

Lack of Project Manager control over O&MN funds.

Practice of directing project funds to Participating Managers in functional areas instead of to the APML who has lead ILS responsibility.

Lack of flexibility in utilizing different appropriation categories such as APN-1, APN-5, APN-6, APN-7, and O&MN.

(3) Management ability over responsibilities related to basic design and performance is degraded when project funds are directed to Participating Managers in the functional areas instead of to the Class Desk who has the lead engineering responsibility.

2. Model Management

(a) Good Features (Refer to Section V.B.4.a)

(1) A centralized and dedicated effort (within the Model Management Office) is provided toward the support of an out-of-production weapon system.

(2) Response to Fleet reported problems is facilitated (within funding constraints) due to collocation of Model Management Office, and key logistics support groups such as the Cognizant Field Activity (CFA) and Designated Overhaul Point (DOP).

(b) Deficiencies (Refer to Section V. B. 4. b)

(1) Overall program control by the Weapon Systems Manager (WSM) is inadequate due to:

Lack of recognition of WSM authority and responsibilities by all NAVAIRSYSCOM groups, Field Activities, and CNO.

Tendency of functional support groups at NAVAIRSYSCOMHQ and Field Activities not to coordinate decisions having overall program impact with the WSM.

Lack of WSM control over any funds.

Lack of AIRTASK sign-off authority.

Degradation of informal program authority by junior officer and/or colateral assignments to WSM positions.

Degradation of program management objectivity when WSM fitness reports are provided solely by the assigned Field Activity Commanding Officer.

Non-participation of WSM in fitness report and performance evaluations of personnel in functional support areas.

(2) Management ability over an Integrated Logistics Support Program is significantly degraded due to lack of funding control.

(3) Fleet logistics support is significantly restricted due to lack of available program funds when needed.

C. RECOMMENDATIONS

In order to improve the effectiveness of Weapon Systems Management within the Naval Air Systems Command, it is recommended that appropriate action be taken to resolve the deficiencies identified in the conclusions to this study. Furthermore, in those areas where there are

already organizational changes currently underway, it is recommended that special consideration be given toward ensuring that the existing deficiencies are not perpetuated.

APPENDIX A

INTERVIEW OUTLINE

I. General: _____

1. Name: _____

2. Current Position: _____

3. Aircraft System(s): _____

4. How long in current position: _____

   a. If less than three years, give relevant background to current position.

   _____

II. Program Size, Phase, and Activity:

	#1 TMS	#2 TMS	#3 TMS
1. List Aircraft System(s) by Type-Model-Series: (Group Systems as appropriate)			
2. Identify Systems: Pre-Production	____	____	____
In-Production	____	____	____
Out-of-Production	____	____	____
3. Approximate number of Aircraft Systems currently in service	____	____	____
4. Approximate number of years Systems have been in service	____	____	____
5. Approximate funding levels for current year			
R&D/T&E	____	____	____
Procurement	____	____	____
O&MN	____	____	____
OSIP	____	____	____

6. Cognizant assignments to Field Activities:

Basic Design Cog	____	____	____
Maintenance Engineering Cog	____	____	____

7. Approximate number of ECP's in last 12 months

____	____	____

III. Project Management Problems:

List the top three problems experienced in managing your project.

1.

2.

3.

IV. Project Management Effectiveness:

1. What actions do you believe should be taken to improve the management effectiveness of your project?

V. Essential Elements to Effective Project Management:

a. Examine the elements listed below in light of requirements that contribute to effective project management. Add any additional requirements not shown that you believe could impact a program.

b. Indicate the RANK ORDER OF SIGNIFICANCE for each element in the RANK column by assigning 1 to the most significant, 2 to the next significant, etc.

ELEMENTS	RANK
CLEARLY DEFINED AND RECOGNIZED AUTHORITY	____
GOOD WORKING RELATIONSHIP WITH CONTRACTOR	____
AVAILABILITY OF FUNDING TO PROJECT (RDT&E, Procurement, O&MN, OSIP)	____
CONTROL OF PROJECT FUNDING (RDT&E, Procurement, O&MN, OSIP)	____
AVAILABILITY OF TRAVEL	____
PROJECT PRIORITY	____
GOOD PROJECT MANAGEMENT TALENT	____
GOOD MANAGEMENT INFORMATION SYSTEM	____
GOOD WORKING RELATIONSHIP WITH CNO AND FLEET COMMANDERS	____
AVAILABILITY OF GOOD ENGINEERING AND LOGISTICS TALENT	____
_____ (additional element)	____
_____ (additional element)	____

APPENDIX B

REPORTED PROJECT AND MODEL MANAGEMENT PROBLEMS

A list of management problems reported from interviewing thirty-five experienced Project and Model Management personnel is provided below. The problem statements have been edited, grouped, and categorized as required for easy reference. Many of the problem statements are the result of inputs from several individuals, and most are the result of more than one input.

A. FUNDING PROBLEMS

1. Lack of flexibility with funding due to different appropriation categories (APN-1, APN-5, APN-6, APN-7, O&MN, etc.).

2. Project Manager has no control over O&MN funds allocated to support his project.

3. Budget changes by Congress, NAVCOMP, and OMB have severe impact on project and increase out-year costs.

4. Budget cycle is inflexible. Budget cycles and project cycles are out-of-synch.

5. Project funds on many projects are directed to Participating Managers in the functional groups bypassing the APML who has the lead ILS responsibility. The same problem exists for the Class Desk who has basic design engineering responsibility.

6. Non-control of available funds by Weapon Systems Manager.

7. Lack of adequate funds to Weapon Systems Manager for engineering and logistics support of older aircraft.

B. PROBLEMS WITH HIGHER AUTHORITY

1. Lack of adequate project support and funding from higher authority.

2. Ambiguous and frequently changing requirements from higher authority.

3. Micro-Management from higher authority.

4. Excessive demands on Project Manager and staff's time for briefs and pre-briefs to higher authority.

5. Extensive paperwork, documentation, DCP's, test plans, and details for higher authority.

6. General requirement to not be completely honest in order to get things done and keep project moving.

C. PERSONNEL RESOURCES PROBLEMS

1. Continually diminishing engineering and logistics talent. Due to lack of sufficient personnel, never able to spend enough time on any given project to do an adequate job.

2. Individual and parochial interest and general lack of overall motivation interferes with project interest.

3. Slow Command response to personnel requirements.

4. Lack of qualified personnel in engineering and logistics functional areas.

5. Lack of career development and promotional opportunities for civilian staff within the project office.

D. MANAGEMENT AND ORGANIZATION PROBLEMS

1. Lack of proper communication and coordination between project office and project team members in functional areas. Also, between other project managers on common equipments.

2. Uncertainty of organizational elements in support of project.

3. Need better definition of Project and Model Management responsibilities, authority, and interrelationship.

4. More authority and responsibility is needed over individuals assigned to functional groups.

5. Difficult to generate team spirit in matrix organization.

6. Weapon Systems Manager's responsibilities are not fully supported by NAVAIRSYSCOM - responsibilities exceed authority.

7. Program decisions made by functional groups are not coordinated with the Weapon Systems Manager.

8. Lack of functional and Field Activity support for old aircraft.

APPENDIX C

ESSENTIAL ELEMENTS TO EFFECTIVE PROGRAM MANAGEMENT

The following tables contain the results of an evaluation to determine those elements considered essential to effective program management. A proposed list of elements was presented to seventeen experienced Project and Model Management personnel during an interview. They were asked to revise the list as required and then rank them in order of significance. In the following tables, the Pre-Production, Production, and Out-of-Production Phases are represented by Phases 1, 2, and 3 respectively.

Table B-1 presents the raw data from the seventeen managers asked to rank the elements. The Project Phase column represents a given project that is currently managing weapon systems in the phases shown. For example, a project having systems in all three phases would be represented by phases 1, 2, 3. Those elements considered most essential were ranked number one and those least essential were ranked number ten. Some managers assigned equal ranking to several elements, and these are shown by their fractional location on a scale from one to ten.

Table B-2 presents the weighted average results of the ranked elements for each separate phase category and for the combination of

phases 1 and 2. For example, since Project Management involves management of weapon systems in both phases 1 and 2, the far right column represents the weighted average results for Project Management. Likewise, Model Management is represented by the phase 3 column since it only involves the management of out-of-production weapon systems.

TABLE C-1

RANKING DATA OF ESSENTIAL ELEMENTS TO EFFECTIVE PROGRAM MANAGEMENT

PROJ PHASE	AVAIL ENG TALENT	WK REL W/CNO & FLEET	MIS	PROJ MGMT TALENT	PRIORITY	AVAIL TRAVEL FUNDS	FUND CONTROL	FUND AVAIL	WK REL W/CONTR	AUTH
1,2,3	2	5	8	4	6	10	1	3	9	7
2,3	2	5	9	1.5	6	9	3.5	3.5	7	9
2	7	6	8	4	5	9	2	1	10	3
2	4	7	5	3	9	10	2	1	6	8
2	4	9	6	3	7	10	2	1	8	5
2	3	8	8	3	8	8	3	3	8	3
1,2,3	3	9.5	7.5	7.5	9.5	5.5	3	5.5	3	1
1	7	4	10	5	1	9	3	2	8	6
2	2	7	3	1	8	10	5	6	9	4
1	7.5	7.5	7.5	2.5	7.5	7.5	2.5	2.5	2.5	7.5
1	8	8	8	4	3	8	1.5	1.5	8	5
1,2,3	3	7	10	2	6	9	5	4	8	1
1	6	8	5	2	9	10	4	1	7	3
1,2,3	7	10	9	5	1	8	3	4	6	2
3	7	9	2	6	5	8	4	3	10	1
3	4	2	10	7	6	8	9	1	5	3
3	7	9	2	6	5	8	4	3	10	1

TABLE C-2

RANKING RESULTS (WEIGHTED AVERAGE) OF

ESSENTIAL ELEMENTS TO EFFECTIVE PROGRAM MANAGEMENT

ELEMENT	PHASE 1	PHASE 2	PHASE 3	PHASES 1&2
Availability of funding to the project	1.5	2	2	1
Control of project funding	1.5	1	3	2
Good project management talent	3.5	3	4	3
Clearly defined and recognized authority	3.5	5	1	4
Availability of good engineering talent	6	4	5	5
Project priority	5	6	6	6
Good working relationship with CNO and Fleet Commanders	8	7.5	7	7
Good working relationship with contractor	7	9	9	8
Good management information system	9	7.5	8	9
Availability of travel funds	10	10	10	10

APPENDIX D

DEFINITION OF GENERAL TERMS AND PROJECT RELATED MANAGERS

1. General Terms

a. Defense Systems Acquisition Review Council (DSARC): An advisory body to the Secretary of Defense on major systems acquisition. The Council members are the OSD staff principals [DOD DIR 5000.1/ 5000.2].

b. Field Activity: A subordinate Command remotely located to the Naval Air Systems Command Headquarters in Washington, D.C.

c. Functional Group or Organization: An organization that is functionally categorized by activity, discipline, or product. Refer to Section II.B.1 for a more detailed description.

d. Integrated Logistics Support (ILS): The support effort required to integrate the various elements of supply and maintenance that is essential to proper operation of a weapon system in the Fleet [SECNAVINST 4000.29A, OPNAVINST 4100.3A, NAVMATINST 4000.20A].

e. Life-Cycle: The complete life of a weapon system which includes its acquisition, deployment and retirement. The three life-cycle phases, as defined in this study, are Pre-Production, Production, and Out-of-Production Phases.

f. Matrix Organization: A hybrid between the functional and project organization in which assigned personnel receive project direction

from the Project Manager while remaining in their functional groups for administrative supervision. Refer to Section II. B. 3 for a more detailed description.

g. Model Management: Weapon systems management during the Out-of-Production Phase of the weapon system's life-cycle as defined in NAVAIRINST 5400. 70. The program is normally assigned to a Weapon Systems Manager (WSM) at a designated Field Activity.

h. Navy System Acquisition Review Council (NSARC): A council established by the Secretary of the Navy as an advisory body to him and through him to the Secretary of Defense on major system acquisitions. The NSARC is chaired by the Secretary/Under Secretary of the Navy and is similar in functional composition, responsibilities and operation to the DSARC [DOD DIR 5000. 1/5000. 2].

i. Project Management: Weapon systems management during the Pre-Production and Production Phases of the weapon system's life-cycle as defined in DOD INST 7000. 1 and the project charter. Major programs are normally assigned to a Project Manager (PMA) and minor programs to an Aircraft Project Coordinator (APC), both located at NAVAIRSYSCOMHQ.

j. Project Organization: An organization that is characterized by output or purpose. It is a self-contained organization that combines many functional skills whose emphasis is on cost and schedule. All project personnel are both functionally and administratively assigned

to the Project Manager. Refer to Section II.B.2 for a more detailed description.

k. Systems Acquisition Process: A sequence of specified decision events and phases of activity directed to achievement of established program objectives in the acquisition of weapon systems. The process extends from approval of mission need, through exploration of alternative systems, competitive demonstrations, full scale development, test and evaluation, production, and successful deployment or termination of the program.

l. Weapon Systems Management: The centralized management and integration of all aspects of a weapon system throughout its complete life-cycle. This includes Project Management during the Pre-Production and Production Phases and Model Management during the Out-of-Production Phase.

2. Chief of Naval Operations Managers

a. Appropriation Sponsor: The Appropriation Sponsor is a DCNO (Deputy Chief of Naval Operations) or DMSO (Deputy Major Staff Office) with supervisory control over an appropriation. The Director RDT&E (OP-098) is Appropriation Sponsor for RDT&E appropriations.

b. Mission Sponsor: A Mission Sponsor is a DCNO or DMSO responsible for developing the overall goals, objectives, rationale, justification, and resource requirements, for a specified mission area. The mission sponsor has a "birth-to-death" interest in the systems under his cognizance.

c. Function Sponsor: A Function Sponsor is the DCNO or DMSO responsible for the preparation, substantiation, and justification of a Navy position on the level, composition, and related direct support for a force, platform, or support area. He receives guidance from the Mission Sponsor relative to mission related requirements.

d. Program Sponsor: A Program Sponsor is a DCNO or DMSO who is responsible for determining program objectives, time phased support requirements, and for appraising progress, readiness, and military worth for a given weapon system. His efforts are in support of the goals and objectives of the appropriate Mission Sponsor.

e. Program Coordinator: The Program Coordinator is responsible to the Program Sponsor for formulation and administration of an acquisition program. He is the focal point for all input-output OPNAV actions. The Program Coordinator for Aircraft and Weapons is OP-506.

3. Project Related NAVAIRSYSCOM Managers

a. Project Manager, Aircraft (PMA): The PMA is a Chief of Naval Material chartered manager of a major project (cost in excess of $75 million for RDT&E and $300 million for procurement). His position is normally established within the Naval Air Systems Command.

b. Aircraft Project Coordinator (APC): The APC is designated by and established within the Naval Air Systems Command as a manager of less than major projects. His functions are essentially the same as that of a PMA.

c. Weapon Systems Manager (WSM): The WSM is a manager of an out-of-production aircraft weapon system assigned by the Naval Air Systems Command (AIR-04) to a Field Activity. The purpose of assignment of a WSM is part of the NAVAIRSYSCOM Model Management Program (NAVAIRINST 5400.70) to decentralize management responsibilities at the Headquarters level. It is a logical extension of the transition of AIR-04 maintenance engineering and AIR-05 basic design engineering responsibilities to a Field Activity such as a Naval Air Rework Facility.

d. Class Desk (AIR-510): The NAVAIRSYSCOM Class Desk has the lead engineering responsibility for basic weapon systems design and performance. He is an extremely important member of the project team especially during the systems acquisition phase.

e. Assistant Project Manager, Logistics (APML/AIR-410): The APML plans and manages the integrated logistics support (ILS) of the weapon system. The APML also assumes the lead management position within the functional groups at NAVAIRSYSCOM for out-of-production systems during the transition period prior to assignment to a WSM at a Field Activity.

f. Requiring Manager (RM): The administrator of a budget within NAVAIRSYSCOM who has the authority to direct project funds by Project Directive (PD) which authorizes fund commitment. The Requiring Manager is normally a designated official among the project office staff.

g. Participating Manager (PARM): A designated manager within the functional groups in NAVAIRSYSCOM that has the authority to initiate and/or commit project funds identified by Project Directive in an appropriate funding document such as a Procurement Request, Project Order, Work Request, Requisition, etc.

APPENDIX E

GLOSSARY OF ABBREVIATIONS AND ACRONYMS

APC	Aircraft Project Coordinator
APML	Assistant Project Manager, Logistics
APN	Aircraft Procurement Navy
ASN	Assistant Secretary of the Navy
ASO	Aviation Supply Office
ASW	Anti-Submarine Warfare
ASPR	Arm Services Procurement Regulations
BIS	Board of Inspection Survey
CBO	Congressional Budget Office
CFA	Cognizant Field Activity
CILOP	Conversion In Lieu of Procurement
CNM	Chief of Naval Material
CNO	Chief of Naval Operations
COMNAVAIR	Commander of the Naval Air Systems Command
DCAA	Defense Contract Audit Agency
DCAS	Defense Contract Administration Service
DCNO	Deputy Chief of Naval Operations
DCP	Decision Coordinating Paper
DMSO	Deputy Major Staff Office (within CNO)
DOD	Department of Defense

DOP	Designated Overhaul Point
DSA	Defense Supply Agency
DSARC	Defense Systems Acquisition Review Council
GAO	General Accounting Office
ILS	Integrated Logistics Support
JFM	Joint Force Memorandum
JSOP	Joint Strategic Objectives Plan
NADC	Naval Air Development Center
NAEC	Naval Air Engineering Center
NALC	Naval Air Logistics Command
NARF	Naval Air Rework Facility
NATC	Naval Air Test Center
NAVAIRINST	Naval Air Systems Command Instruction
NAVAIRSYSCOM	Naval Air Systems Command
NAVAIRSYSCOMHQ	Naval Air Systems Command Headquarters
NAVCOMPT	Comptroller of the Navy
NAVELEXSYSCOM	Naval Electronics Systems Command
NAVFACENGCOM	Naval Facilities Engineering Command
NAVSHIPSYSCOM	Naval Ships Systems Command
NAVSUPSYSCOM	Naval Supply Systems Command
NOL	Naval Ordnance Laboratory
NPSO	Naval Procurement Supply Office
NRL	Naval Research Laboratory
NTEC	Naval Test Engineering Center

NSA	National Security Agency
NSARC	Naval Systems Acquisition Review Council
NSC	National Security Council
NWC	Naval Weapons Cenfer
OFPP	Office of Federal Procurement Policy
O&MN	Operations and Maintenance, Navy
OMB	Office of Management and Budget
ONR	Office of Naval Research
OPEVAL	Operation Evaluation
OPN	Other Procurement Navy
OPNAV	Office of the Chief of Naval Operations
OPNAVINST	Chief of Naval Operations Instruction
OPTEVFOR	Operational Test and Evaluation Forces
OSD	Office of the Secretary of Defense
OSIP	Operational Safety Improvement Program
PM	Program or Project Manager
PMA	Project Manager, Aircraft
POM	Program Objectives Memorandum
PPBS	Planning, Programming and Budgeting System
RDT&E	Research, Development, Test and Evaluation
RISE	Readiness Improvement Status Evaluation
SAR	Selected Acquisition Review
SCN	Shipbuilding and Conversion, Navy
SECDEF	Secretary of Defense

SECNAV	Secretary of the Navy
SECNAVINST	Secretary of the Navy Instruction
SLEP	Service Life Extension Program
SPCC	Ships Parts Control Center
SSE	Special Support Equipment
T&E	Test and Evaluation
UR	Unsatisfactory Report
WSAM	Weapon Systems Acquisition Management
WSPD	Weapon Systems Planning Document
WPN	Weapons Procurement, Navy
WSEG	Weapon Systems Evaluation Group
WSM	Weapon Systems Manager
3M	Maintenance and Material Management Information System

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